

Metal Finishing

POLISHING AND BUFFING • BARREL FINISHING • CLEANING
PLATING • ANODIZING • RUST PROOFING • LACQUERING & ENAMELING

DECEMBER, 1959

CONTENTS:

Metal Finishing in Europe Today

France, Italy, and Germany

Testing Plating Durability

The Copper-Accelerated Acetic Acid Test

Do You Appreciate the Dilemma of Depreciation?

Allowances and How Determined

Infra Red Baking of Organic Finishes

Production Methods

Finishing Pointers

Control of Watts Nickel Baths

Science for Electroplaters

Complex Cyanide Baths

Annual Comprehensive Index

Cross-Reference of Material which Appeared In Our 1959 Issues

Complete Contents Page 51

Read and pass on—

HOW TO CHOOSE AN ABRASIVE TUMBLING COMPOUND

Whatever your abrasive tumbling application, here's how to select the exact compound to meet your requirements:

1. Choose from a broad line of compounds developed by barrel finishing specialists.
2. Have a barrel finishing expert work with you to assure top product performance in the application.

When you buy a CLEPO abrasive tumbling compound, you get both.

Special compounds for unusual requirements are designed in the Gumm testing and research laboratories and barrel-tumbling pilot plant.



For complete data on barrel finishing, 20-page CLEPO Barrel Finishing Manual available on letterhead request.

Some of
the Many
CLEPO
Tumbling
Compounds
Available

CLEPO 171-A

For polishing hardened steels to produce extremely low microinch finish

CLEPO 14-W

For light cutting and removing fine burrs from brass or copper

CLEPO 14-R

For medium cutting and deburring of steel, brass, copper

CLEPO 205-J

For fast cutting of the hardest steel and alloys

CLEPO 214-A

For long heavy grinding of sand castings and steel

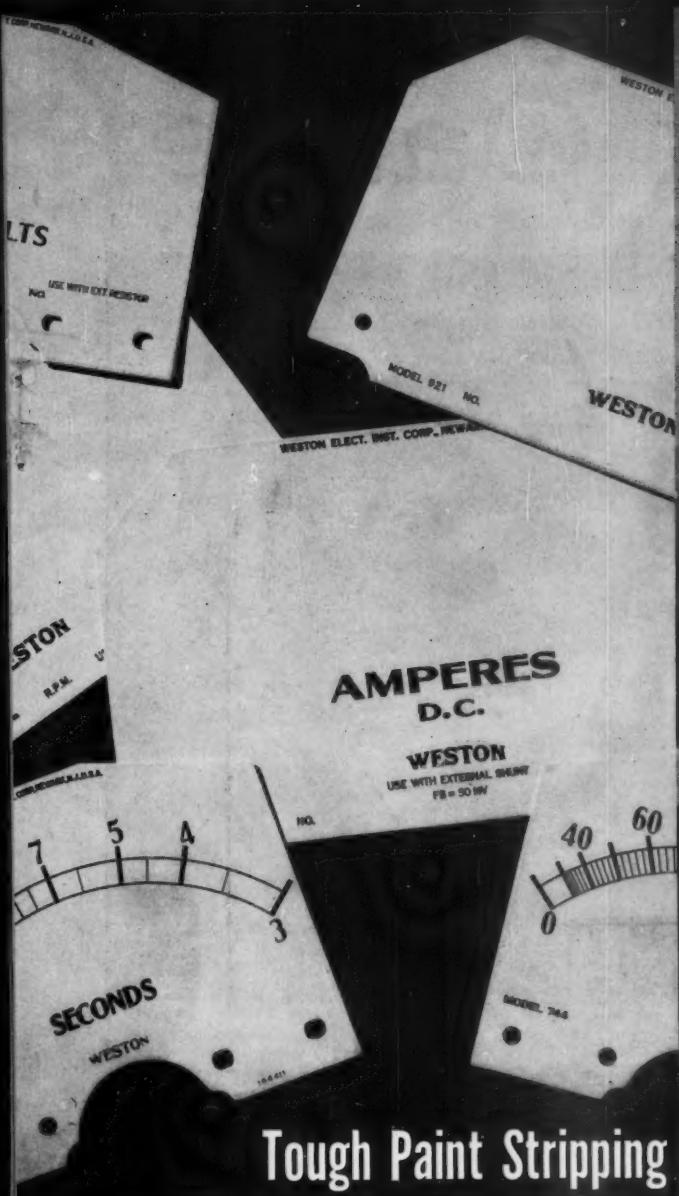
CLEPO 19-D

For rough cutting steel to produce heavy matte finish

FREDERICK

G U M M

CHEMICAL COMPANY INC.
538 Forest Street, Kearny, N. J.



Tough Paint Stripping Problems . . . Custom-solved!

Problem: To remove two coats of specially formulated non-yellowing white baked synthetic enamel, printing, and clear baked enamel top-coat from these Weston Scale plates.

The many factors that affect paint stripping—type of paint, condition of the metal surface, presence or absence of conversion coatings, method of paint application, baking cycle—make every stripping job unique in itself. In most cases, only laboratory tests on your parts or test panels, and proper evaluation of all the

Enthon Stripper Q-561 (specifically developed for Weston Instrument Division of Daystrom, Inc.) breaks the bond between the coatings and the brass or nickel plated brass basis metal.

factors involved, can produce the most economical and efficient stripper for your application. Only Enthonics can do this custom research and development job in depth. Write for brochure describing our paint stripping laboratory service. Enthon, Incorporated, 442 Elm Street, New Haven, Connecticut.

ANOTHER PRODUCT OF *Enthonics* RESEARCH

ENTHONE
A Subsidiary of American Smelting and Refining Company

ASARCO

*For the best
in reverse-current
cleaning*

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 FIELD SERVICE MEN • OVER 160 MATERIALS



3 good reasons why Oakite 90 electrocleaner minimizes plating rejects:

High conductivity, superior smut removal and water-softening ability—there's a trio of good reasons why parts come out of Oakite 90 reverse current baths really ready for electroplating, with no soil nor film to cause subsequent rejection.

(1) High conductivity, of course, puts most of the current to work actually cleaning, instead of dissipating power in overcoming resistance. (2) The superior smut removal stems from Oakite 90's excellent wetting, emulsifying and suspending action that *not only* prys soil off but also prevents redeposition. (3) The water-softening action prevents hard-water scums from forming and clinging to parts as they're drawn from the tank.

Add to these... controlled foaming that traps alkaline spray, and exceptionally long solution

life... still more reasons why Oakite 90 is the "Number One" choice of platers across the country.

Ask the Oakite man to demonstrate Oakite 90, or write for FREE Bulletin. Oakite Products, Inc., 40 Rector Street, New York 6, N. Y.

it PAYS to ask Oakite



61

... for 61 years!

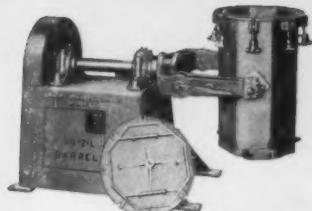
**Manufacturing Reliance
Plating, Polishing Equipment,
Supplies for Better and
More Profitable Metal Finishing**

Chas. F. L'Hommedieu & Sons Co.



No. 18 — VARIABLE SPEED POLISHING LATHE

Independent spindles—each with separate patented Variable Speed Drive and controls — ball-bearing throughout. Powered by two up to 25 H.P. motors. Adopted by leading manufacturers as standard equipment.



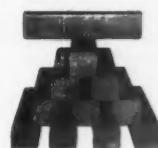
**TYPE L — DOUBLE ACTION BARREL
For ABRASIVE TUMBLING or BALL BURNISHING**

The cylinder can be operated at an angle for producing a double tumbling action—thus producing a better and more uniform finish in a much shorter time.

Longer pieces finished more uniformly and without bending.



RELIANCE KUL-KUT BUFFS
FOR FAST CUTTING



RELIANCE EXTRUDED
COMPOSITIONS

STANDARD SIZE
 $2 \times 2 \times 10''$

THEY CUT • THEY CLEAN • THEY COLOR

- DURABILITY
- PRODUCTION
- ECONOMY
- EFFICIENCY

THE ANSWER TO INCREASED
PRODUCTION AT LOWER COST!

Manufacturers of Metal Finishing Equipment and Supplies

Chas. F. L'Hommedieu & Sons Co.

General Office and Factory

4521 Ogden Ave., Chicago 23, Illinois

Chas. B. Little Co.
Newark, N. J.

W. R. Shields Co.
Detroit, Mich.

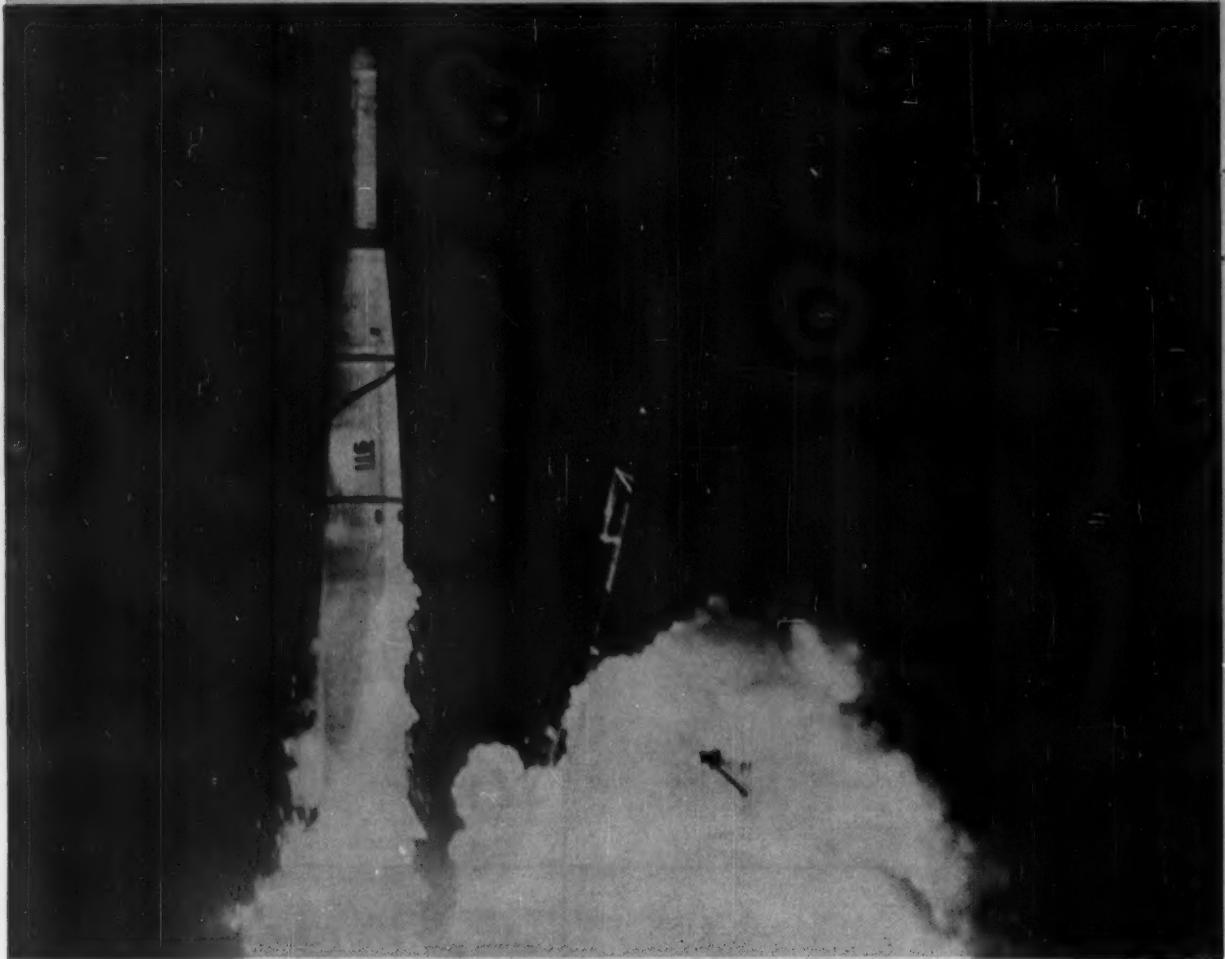
Branches:
Cleveland & Los Angeles





metal cleaning report no. 4

case histories from your distributor of Dow solvents



MISSILE COMPONENTS . . . no place for "almost clean"

An aircraft parts manufacturer, under sub-contract to deliver missile components, had a serious production problem. His regular vapor-degreasing solvent gave results which, at best, were not quite good enough for certain critical missile parts. As a result of a consultation with his distributor of Dow solvents, this manufacturer put NEU-TRI® to work . . . now his missile components *and* his standard line of aircraft parts come off the line thoroughly cleaned. He also gained a cost advantage: a long-lived neutral stabilizing system built into NEU-TRI prevents early solvent breakdown. Consequently he now can clean more parts with a gallon of solvent than ever before!



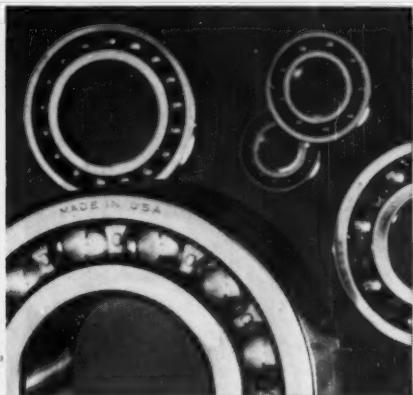
ELECTRICAL PARTS

The bottleneck was tape. This company makes electrical parts. During one stage of assembly, masking tape must be applied to certain critical parts. And the time and careful handling required to remove the tape at final assembly provided a real production bottleneck! They found the answer with Chlorothene® (Dow 1, 1, 1-trichloroethane, inhibited). Because of its high solvent power, Chlorothene takes tape off fast.



ELECTRONIC COMPONENTS

Choice of spray or wipe—This manufacturer of electronic parts states: "Chlorothene is the finest all-around solvent we've ever used." Chlorothene is widely used throughout the plant for both spray and wipe cleaning of the electronic parts, and for cleaning of production equipment! There's no fire or flash point by standard testing methods, and toxicity is very low, which keeps this safety-conscious management happy.



BALL BEARINGS

Teamwork for protection—This bearing manufacturer found nonflammable Dow perchloroethylene an ideal solvent for use in a combination cleaning-and-oil-bath formulation. Completed ball-and-race assemblies, dipped in the solution, came out completely free of all dirt and contaminants deposited during manufacture and assembly . . . while retaining a thin film of oil for protection during packaging and storage.



GAS EQUIPMENT

Solvent cleans-and-goes in a hurry—Cleaning of compressed gas tubes and lines can be a problem, but this company does the job the easy way. On the recommendation of their distributor of Dow solvents, they tried Dow methylene chloride. Its high solvency quickly, thoroughly removes grease, oil and other processing residue . . . and any solvent remaining after treatment evaporates in a hurry!

There's no doubt about efficiency in metal cleaning operations when one or more of the Dow metal cleaning solvents is on the job. Dow offers industry the widest line of chlorinated solvents, each one designed for specific applications and purposes. There's a Dow solvent to meet every solvent-cleaning need . . . one which will do the job efficiently, in short order!

Your distributor of Dow solvents is fully qualified to assist and advise you when problems of metal cleaning arise. Why not take advantage of the wide experience and knowledge which he and his staff have to offer? A call to him may be a shortcut to more efficient, economical metal cleaning in your plant.



FREE . . .
TECHNICAL SERVICE
on 24-hour notice

Your distributor of Dow solvents will gladly help you with any problems you're experiencing with metal cleaning solvents. He'll have a trained solvent specialist en route to your plant within 24 hours after your call is received.

Ask your distributor of Dow solvents for details.

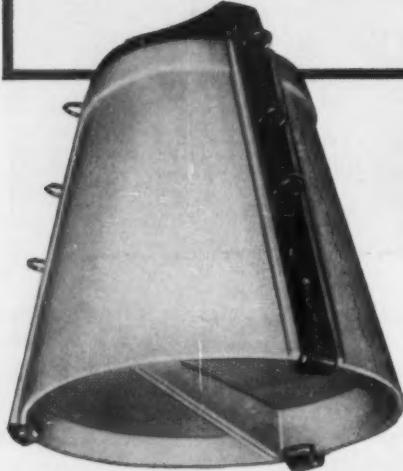
THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

CHLOROTHENE®
TRICHLOROETHYLENE
PERCHLOROETHYLENE
METHYLENE CHLORIDE

See Your Distributor of Dow Solvents First!

NOW!—Stevens ALL NEW Barrel of "MIRACLE" MATERIAL STEVALITE

LIGHTER
STRONGER
LONGER LASTING



Here's Why Stevens Can Offer You a Barrel superior to anything else on the market today:

THE MATERIAL

Stevalite . . . tremendous impact strength . . . heat resistance to 270° F. 50% lighter than any other material.

THE DESIGN

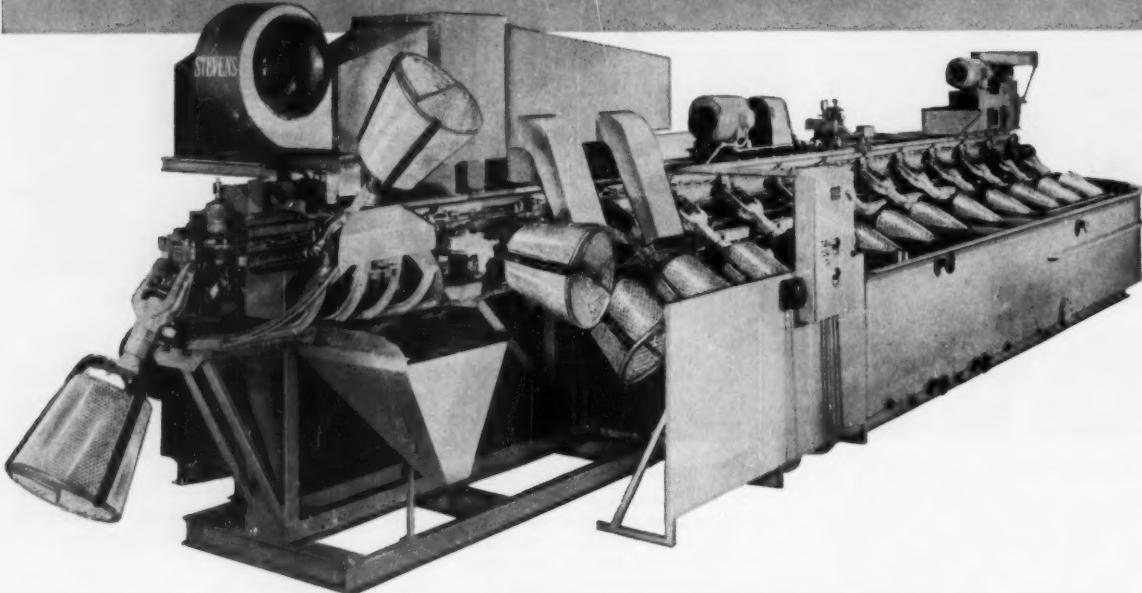
Oblique barrel tumbles parts more effectively giving improved plate distribution. Thinner wall decreases solution dragout. Dense perforation count boosts current draw and plating speed up to 30%. Faster drying.

THE CONSTRUCTION

Rigid, rugged *all welded* . . . unaffected by heat distortion . . . reinforced to resist damage. Minimum number of necessary parts.

You cannot buy a more efficient and productive barrel anywhere. Simple in conception and construction, it can guarantee you real maintenance-free performance and long productive life . . . the perfect barrel.

FOR USE ON ALL STEVENS AUTOMATIC BARREL PLATING-PROCESSING MACHINES



frederic b.

STEVENS, inc.

DETROIT 16, MICH.

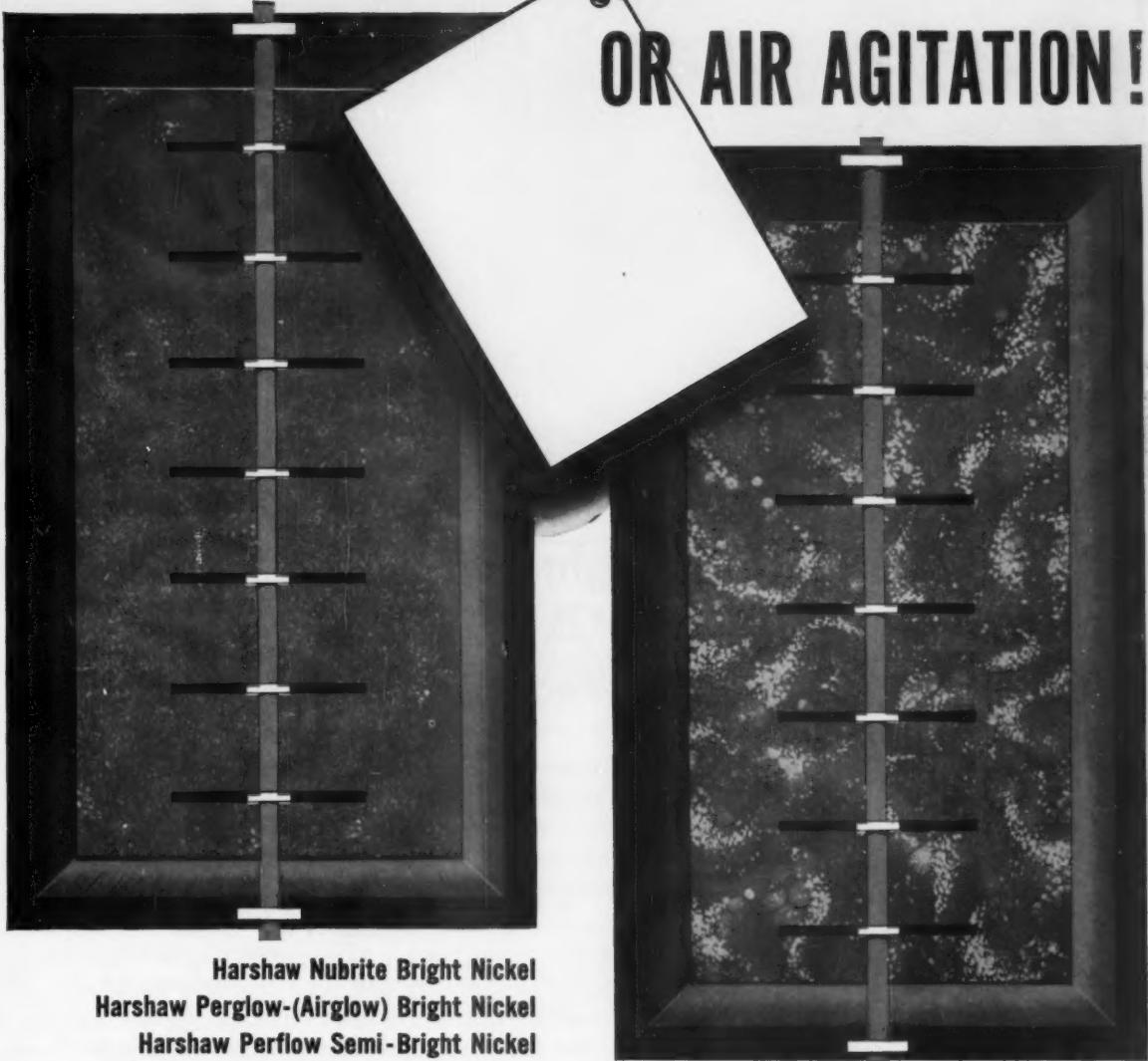
BUFFALO CHICAGO DETROIT CLEVELAND
DAYTON NEW HAVEN INDIANAPOLIS SPRINGFIELD (OHIO)

Remember — When you go automatic . . . go STEVENS!

All HARSHAW Nickel and Copper Plating Processes
Operate Successfully with Either

CATHODE MOVEMENT

OR AIR AGITATION!



Harshaw Nubrite Bright Nickel
Harshaw Perglow-(Airglow) Bright Nickel
Harshaw Perflow Semi-Bright Nickel
Harshaw Perflow-Perglow Duplex Nickel
Harshaw Cynorex Cyanide Bright Copper
Harshaw Cuprex Acid Bright Copper

All Harshaw processes have been highly successful in their operation with mechanical agitation. Where particular conditions have dictated the need for Air Agitation, Harshaw processes are operated very effectively with beneficial results. If your requirements indicate that Air Agitation will benefit you, Harshaw is prepared to offer a suitable process.

The **HARSHAW**
Chemical Company



1945 EAST 97th STREET • CLEVELAND 6, OHIO
Chicago 32, Ill. • Cincinnati 13, Ohio • Cleveland 6, Ohio • Detroit 28, Mich.
Houston 11, Texas • Los Angeles 22, Calif. • Philadelphia 48, Pa. • Pittsburgh
22, Pa. • Hastings-On-Hudson 6, N.Y.



NOW....

**your UDYLITE nickel brighteners come in this new
RIP-OPEN PACKAGE
for greater speed and SAFETY!**



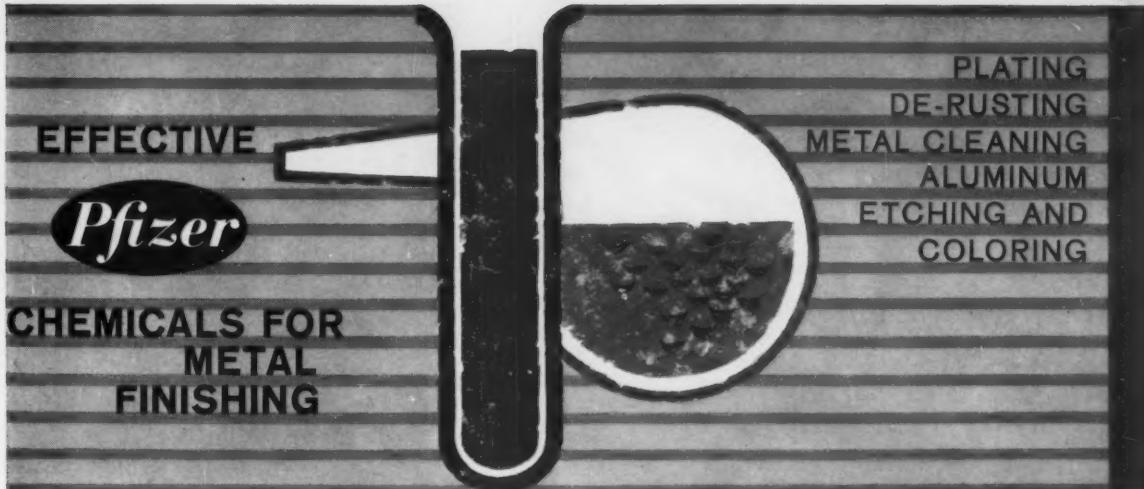
This new Udylite carton provides you with a handy replaceable lid that fits snugly back on the box to keep out dirt and protect the remaining bottles.

This new Rip-Open packaging, just introduced by Udylite, is typical of the attention we feel is due small details. Speedy and easy is the opening job when, with a roundhouse *rip* of the tear-off strip, your carton of Udylite brightener containers is open . . . neatly and evenly.

Here is one more example of why it pays to deal with Udylite—where you can be sure of getting first rate plating supplies of a quality and price that you know you can depend upon. And always at Udylite you find the respect for fine points of performance that makes this the finest plating supply service. If Udylite isn't already your source, investigate now the advantages of dealing with



*detroit 11, michigan
world's largest plating supplier*



	Cleaning	Polishing	Picking	Electroplating	Electropolishing	Non-Electrolytic Depositions	Electrolytic Oxidation	Etching	Gold Coloring of Aluminum
Citric Acid	✓	✓	✓	✓	✓	✓	✓	✓	
Sodium Citrate	✓	✓		✓		✓			
Ammonium Citrate	✓	✓	✓	✓					
Gluconic Acid	✓	✓	✓	✓					✓
Glucono Delta Lactone	✓	✓	✓	✓					✓
Sodium Gluconate	✓	✓		✓					✓
Oxalic Acid	✓	✓	✓	✓	✓		✓	✓	
Ammonium Oxalate	✓	✓		✓					
Ferric Ammonium Oxalate									✓
Tartaric Acid	✓		✓	✓					✓
Tartar Emetic				✓					
Rochelle Salt				✓	✓				
Cream of Tartar	✓			✓					

Citric Acid...
Nontoxic, mild, yet chemically active against scale and tarnish. Used extensively in the formulation of general metal cleaners and polishes, particularly household products.

Sodium Citrate...
A preferred ingredient in electroless nickel baths, resulting in a brighter plate. Also finds wide use in electroplating processes.

Ammonium Citrate...
Especially useful for the removal of rust in near neutral solutions. Extremely mild and safe to handle.

Gluconic Acid...
An excellent sequestering agent in alkaline derusting solutions; provides rust-free, clean surface ready for further treatment. Also highly effective in aluminum etching and paint stripping compounds.

Oxalic Acid...
The most effective chemical for use in automobile radiator clean-

ers. Also finds wide use in electropolishing and as an ingredient in general metal cleaners.

Ferric Ammonium Oxalate...
Used extensively in the production of light-fast gold colored aluminum.

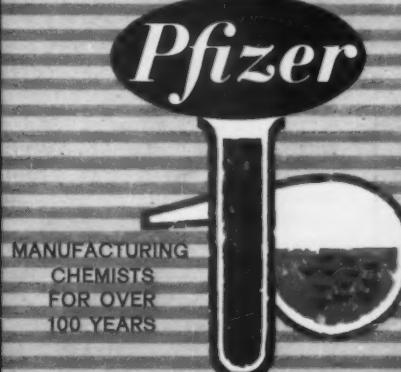
Tartaric Acid...
Excellent complexing agent for copper in electroplating.

Tartar Emetic...
Used in electrolytic baths for deposition of silver and antimony alloys on brass, copper and steel surfaces.

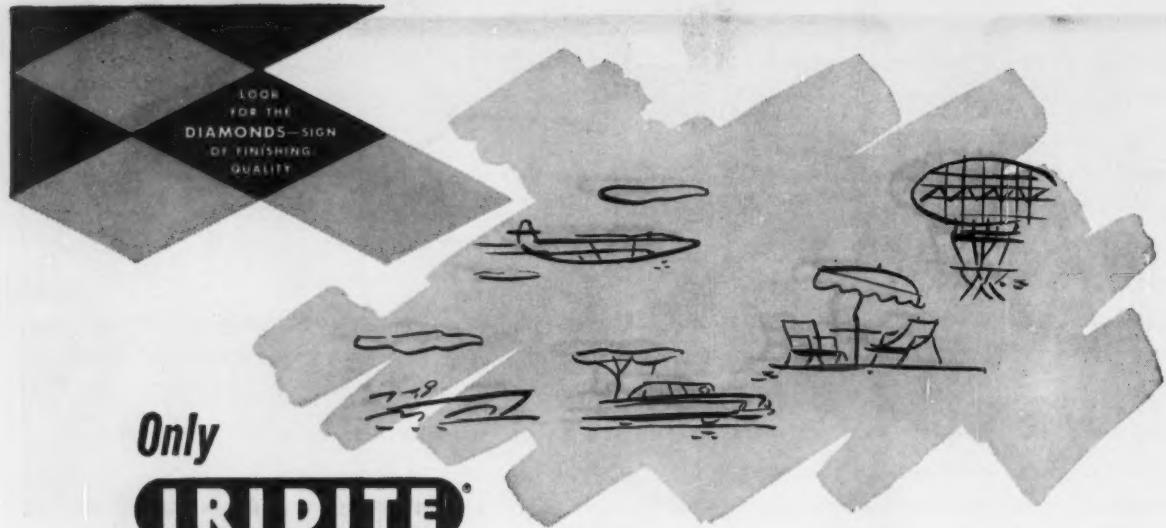
Rochelle Salt...
Increases efficiency and yields finer-grain deposit in alkaline copper plating.

Cream of Tartar...
An excellent additive for brass cleaning compounds. Its crystalline structure acts as an effective abrasive in paste polishes. Chemically active against tarnish.

SCIENCE FOR THE
WORLD'S WELL-BEING...



Chas. Pfizer & Co., Inc.
CHEMICAL SALES DIVISION
630 Flushing Avenue, Brooklyn 6, N.Y.
Branch offices:
Chicago, Ill.; Clifton, N.J.; San Francisco, Calif.;
Atlanta, Ga.; Dallas, Tex.; Montreal, Canada



Only

IRIDITE®

Process Engineered Chromate Conversion Coatings

Give you 5 additional benefits for Corrosion Protection—Paint Base—Decorative Finishing

1 A COMPLETE PROCESS ENGINEERED LINE

Developed for specific applications, there is an Iridite to provide the finish you desire, fit the equipment you have available and give the performance you require. Most Iridite coatings meet rigid military and civilian specifications.

2 EXPERIENCED TECHNICAL SERVICE

Our large field engineering staff is thoroughly familiar with chromate conversion coatings and related finishing operations. They'll help you check every step in your finishing operation to make sure you're getting the best possible finish on your products.

3 PRODUCT AVAILABILITY

Warehouses located in strategic industrial

areas enable us to provide you with fast, economical delivery on any Iridite.

4 ECONOMY

The superior performance of Iridite provides low final cost by extending operating life and lowering maintenance costs. In addition, Iridite gives you a finish that adds considerably to the value of your product. There's an Iridite to meet every cost and performance requirement.

5 RESEARCH AND DEVELOPMENT FACILITIES

If you have an unusual application, we will gladly work with you. Our entire staff of experienced engineers and chemists, and our completely equipped facilities are at your service.

IRIDITE—a specialized line of chromate conversion coatings for non-ferrous metals. Apply by dip, brush or spray methods — at room temperature — manually or with automatic equipment. Forms a thin film which becomes an integral part of the metal. Cannot chip, flake or peel. No special equipment, exhaust systems or specially trained personnel required.

If you are using chromate conversion coatings to finish zinc, cadmium, aluminum, magnesium, silver, copper, brass or bronze — consider the above benefits of Iridite. For complete information, contact your Allied Field Engineer. He's listed under "Plating Supplies" in the yellow pages. Or, write for FREE TECHNICAL DATA FILE.



Chemical and Electro-
chemical Processes, Anodes,
Rectifiers Equipment, and Supplies for Metal Finishing

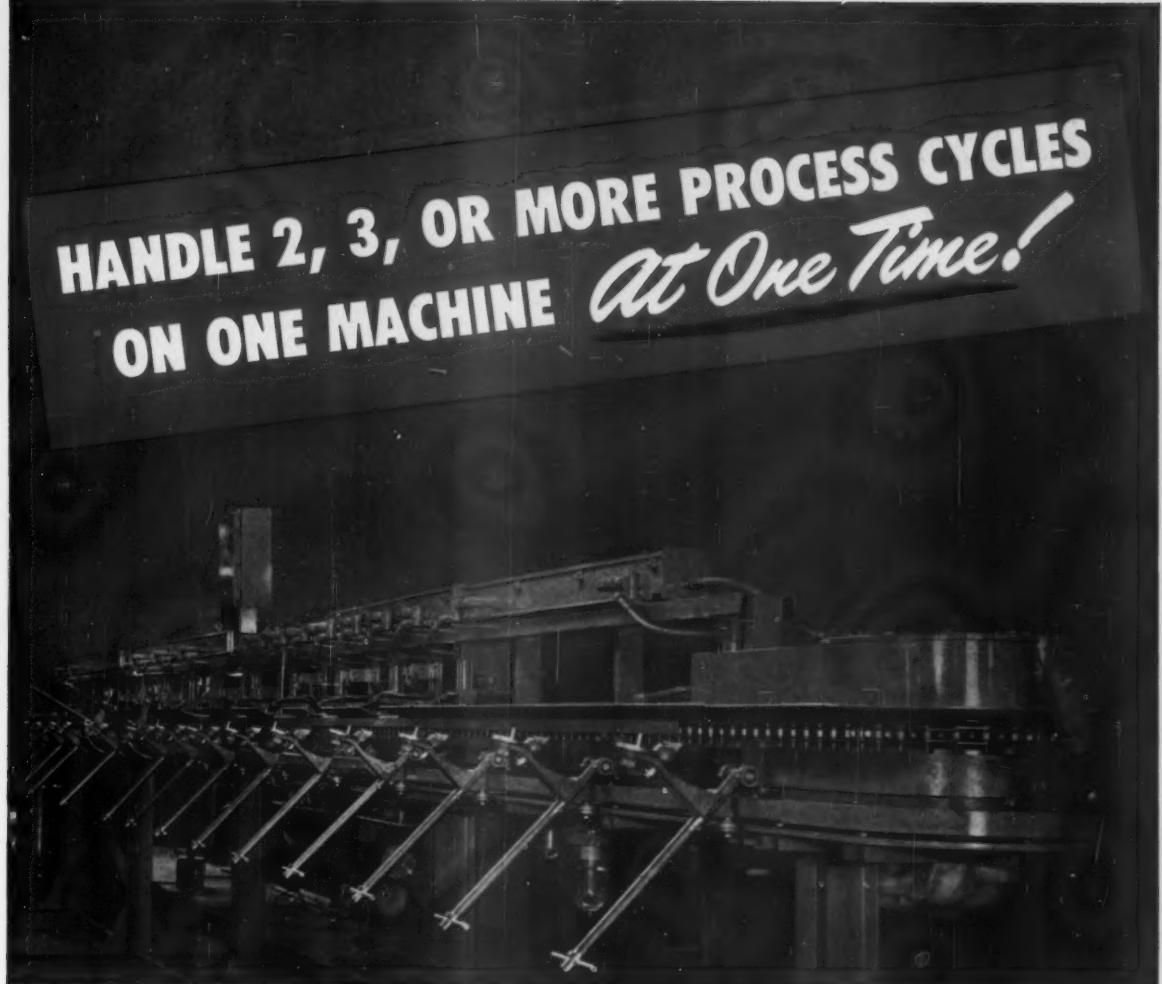
IRIDITE®
Chromate
Coatings

IRILAC™
Clear
Coatings

ISOBRITE®
Plating
Brighteners

ARP®
Chemicals &
Supplies

WAGNER
Line of
Equipment



LASALCO'S Select-O-Matic

MULTIPLE PROCESS PLATER

Another Lasalco development that offers the industry the last word in fully automatic plating!

With the new Select-O-Matic, the operator simply selects the desired process cycle for individual racks, when loading the machine, merely by turning a dial on the carrier. From that point, the rack automatically travels through the entire selected cycle without further attention.

A single Select-O-Matic plater, manned by one

operator, will handle several various processes simultaneously. Different machines for each process are eliminated—original investment in equipment is greatly reduced—much less floor space is needed—maintenance is cut to an absolute minimum.

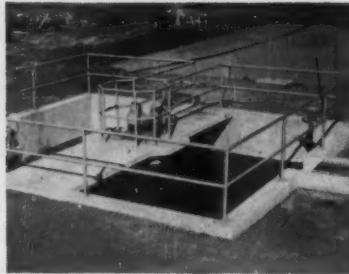
The Select-O-Matic is easily adaptable to any operation. Tell Lasalco about your operation and requirements to learn what this new machine can do for your production and profits.

Write Today!

LASALCO, INC.

HOME OFFICE: 2820 LaSalle St. • St. Louis 4, Mo. • PRespect 1-2990
IN TEXAS: 2805 Allen Street • Dallas, Texas • Riverside 7-5814

*For Every Metal
Finishing Waste!*



VORTI® Mixers

1. Low Power Consumption due to efficient rotor design.
2. Trouble-free operation with no under water bearings.
3. Adapted for rapid mixing, or flocculation.
4. Can be installed in round, square, or rectangular basins.

Bulletin 700

*For Any Degree
of Treatment!*



Chemical Feeders

A complete line for solution, slurry, dry feed, and lime slaking. Adaptable for constant rate operations or proportioning by flow or pH control.

[Request Information](#)

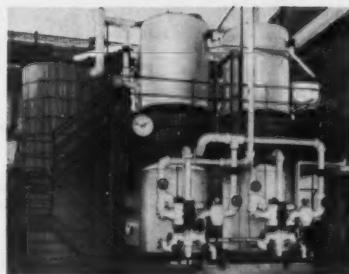
*And for Chemical and
Water Recovery or
Pollution Abatement!*



CYCLATOR® Clarifier

For clarification and precipitation of toxic metals. Controlled slurry recirculation results in better treatment at higher flow rates. Custom designed skimmers available when needed.

Bulletin 850



CATEXER® ANEXER®

Ion Exchangers

recover chemicals and rinse water in many cases. For chromic acid purification and many recovery applications. Each problem is evaluated to determine the economics of recovery operations with the equipment custom engineered for each application.

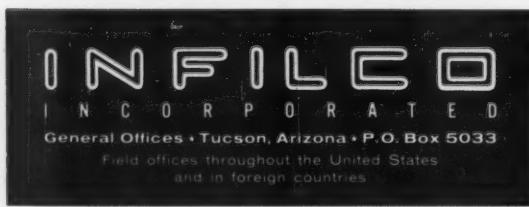
Bulletin 1960

INFILCO
Has the Equipment!



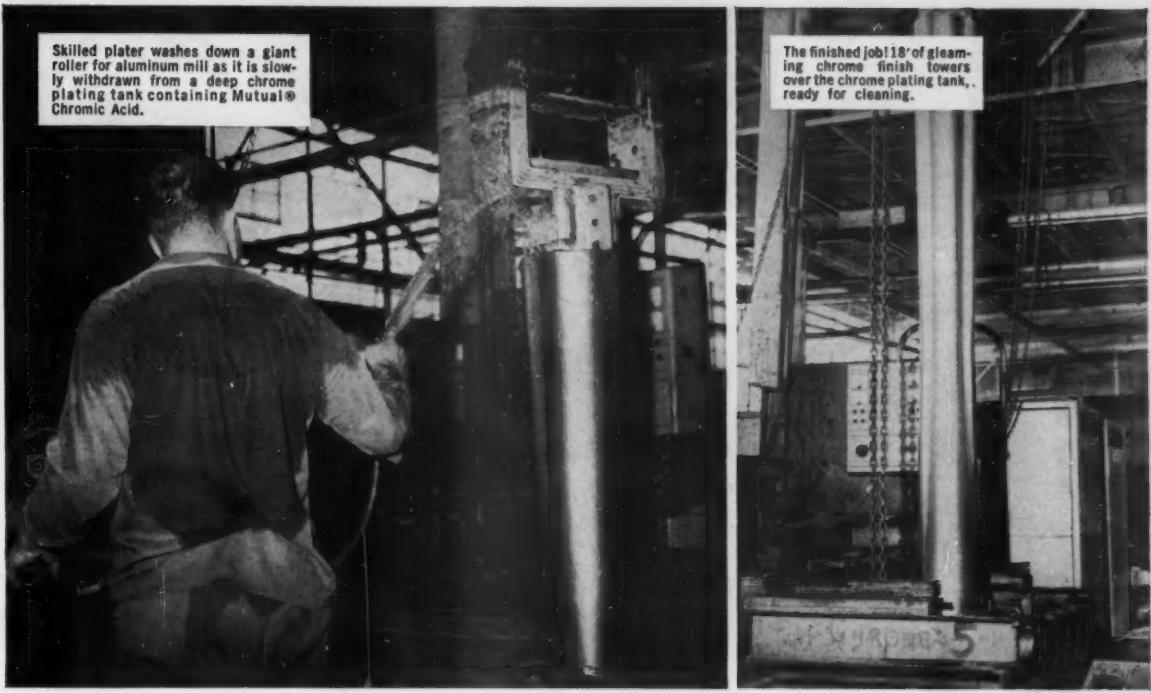
**INFILCO will help you and your engineers evaluate
any metal finishing waste disposal problem**

Let us help you find the *best* way to meet your particular needs—the one combination of equipment for most economical results. Write for Bulletin 80 to acquaint you with the complete line of INFILCO equipment—for every type of water and waste treatment problem.



57441

THE ONLY COMPANY impartially offering equipment for ALL types of water and waste processing—coagulation, precipitation, sedimentation, flotation, filtration, ion exchange and biological treatment.



Simmons Vertically Plates 18' Roller For Aluminum With MUTUAL CHROMIC ACID

Being *vertically* chrome plated for use on the world's largest rolling mill—a 170-inch-wide reversing mill at the Reynolds Metals Company Alloys Plant, Listerhill (Sheffield), Alabama—are giant steel rollers for carrying aluminum ingots.

The Simmons Plating Works of Atlanta, Georgia immerses each roller in a 28' deep chrome plating tank containing Mutual Chromic Acid. The vertical plating process provides a faster, better quality plating job over the entire surface of the roller. Each roller is plated to .005" minimum thickness in a standard 33 oz. per gal. chromium plating solution at normal plating temperatures of 130°F.

Like many other skilled platers throughout the country,

Simmons relies on high purity Mutual Chromic Acid to provide a chrome plate that gives longer wear and resistance to rust and corrosion. Plating with Mutual Chromic Acid also helps to protect the rollers from damaging or scratching the aluminum ingots they convey.

Mutual Chromic Acid is always 99.75% pure—or better. Sulfate content never exceeds 0.1%. Rigid quality control insures that the chromic acid you get is always the same. This makes it easier for you to control accurately the chromic acid-sulfate ratio of your plating bath.

For information on Mutual Chromic Acid, as well as other Mutual chromium chemicals, send coupon for our free booklet, "Chromium Chemicals." Our Technical Service staff will also be happy to answer your questions.

OTHER PRODUCTS FOR PLATERS
SOLVAY® Caustic Potash • SOLVAY Caustic Soda
SOLVAY Hydrogen Peroxide • SOLVAY Methylene Chloride



SOLVAY PROCESS DIVISION
61 Broadway, New York 6, N. Y.

MUTUAL chromium chemicals are available through dealers and SOLVAY branch offices located in major centers from coast to coast. Send export inquiries to Allied Chemical International, 40 Rector St., New York 6.

SOLVAY PROCESS DIVISION
Allied Chemical Corporation
61 Broadway, New York 6, N. Y.

- Send Bulletin 52, "Chromium Chemicals"
 Have a representative phone for appointment

Name _____

Position _____

Company _____

Phone _____

Address _____

City _____ Zone _____ State _____

9-129

A UDYLITE TRIPLE PLAY . . .

PAN AMERICAN

WORLD'S MOST EXPERIENCED



ERNIE TO ELLEN TO JOHANNESBURG

Not customary but entirely "in order" is this shipment rushed by Udylite special messenger Ernie Jennings direct to planeside in Detroit, where

Pan-Am stewardess Ellen Manners starts it on its way to South Africa.

Just 39 hours later delivery is made in Johannesburg, 9036 miles away.

If your problem is as urgent as this, or if you just need quality supplies promptly delivered, you know you can count on Udylite supply services to meet your every demand. Discover how it works yourself.

Place your next order with Udylite.

world's largest
plating supplier



corporation

detroit 11, michigan

on the west coast: the l. h. butcher company • los angeles, california

Another new Wyandotte
research-developed



metal-cleaning product!

NEW NORDALL emulsion cleaner locks out rust safely!



Here is a remarkable new emulsion cleaner that protects against rust longer—and without fire hazard, too! . . . Wyandotte's NEW NORDALL®!

Designed for spray cleaning steel, cast iron, and other metals either hot or cold, New NORDALL protects for up to *six weeks* in plant atmospheres. Perfectly suited for rust prevention between machining operations!

Non-evaporating even at high temperatures, New NORDALL is non-foaming in high-pressure, turbulent washers. And New NORDALL has a higher, very safe flash point—over 300° F! And it's nontoxic and essentially odorless.

For details of this extraordinary rust-proofing emulsion cleaner, call in your Wyandotte representative soon. TODAY, perhaps? *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.*

Other new Wyandotte products

MIL-ETCH®—Caustic-type aluminum etchant eliminates scale, produces bright matte finish, reduces maintenance.

MAXAMP*—Free-flowing, 100%-soluble steel electro-cleaner offers maximum detergency, superior smut removal. Also used for zinc phosphate removal; chromium-plate stripping.

FERLON®—Alkaline derusting compound removes rust, light scale, oil, grease, paint, smut without harm to ferrous metals.

BUFSOL—The all-soluble product that lets you remove stubborn buffering compounds the modern, trouble-free way—with solvents.

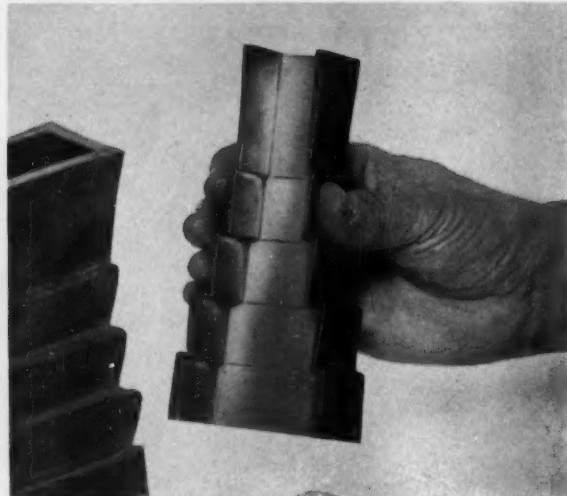
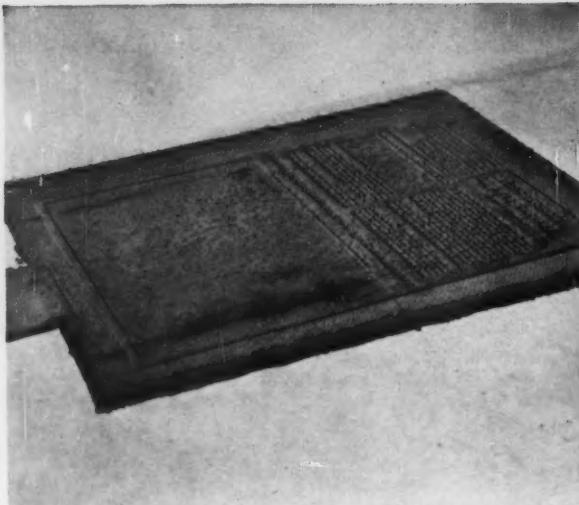
*TRADEMARK



Wyandotte CHEMICALS

J. B. FORD DIVISION

The Best in Chemical Products for Metal Finishing



In electrotyping, plating rotogravure rolls, electroforming, "Plus-4" Copper Anodes cut plating costs

ELECTROTYERS have discovered that, in addition to eliminating the use of bags and diaphragms, they can place "Plus-4" (Phosphorized Copper) Anodes closer to the cathodes — speed up the plating cycle 30% or more with the same power input — and still obtain a smooth deposit. As an alternate, power can be reduced by one-third with an equal reduction in resistance and generation of heat to obtain finished electros in the same plating time. This is an important advantage when thermoplastic plates or molds are used and tanks must run no higher than 95F.

MAKERS OF ROTOGRAVURE ROLLS have found that "Plus-4" Anodes provide a much finer, smoother surface for polishing and etching, and retain the quality of the light tones in runs of over one million impressions on a single set of design cylinders.

In addition, they report significant reductions in cost. One publisher found that he produces superior rolls with less labor and a reduction of 18 to 20% for materials required in the plating process. Another reports he gets a dividend of eight extra rolls for each tank load of "Plus-4" Anodes. And still another has found a 15% saving in over-all costs.

IN ELECTROFORMING operations, "Plus-4" Anodes — by eliminating the most prevalent acid-copper plating difficulties — have made it practical to produce many new products. Their ability to provide a smooth, dense deposit relatively free from growths and blemishes made possible relatively thick shells for molds used in making rubber and plastic articles, and in intricate precision parts for electronic use. Electroformers report operating economies similar to those found in the graphic arts field.

WRITE FOR INFORMATION on how you can obtain a test quantity to supply one tank. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass, Ltd., New Toronto, Toronto 14, Ontario.

BB106

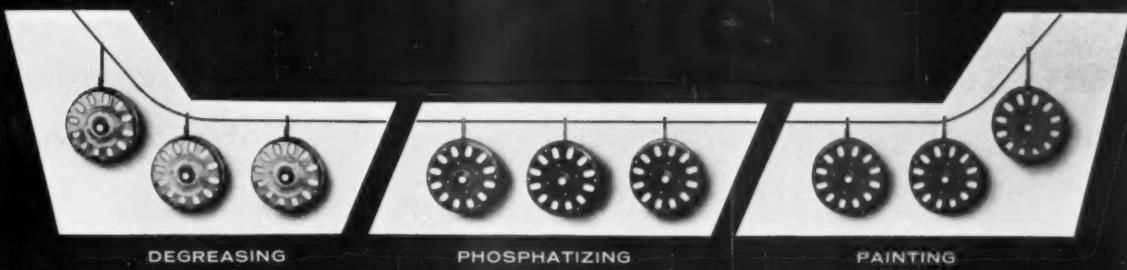
ANACONDA®

"PLUS-4"® ANODES Phosphorized Copper

Made by The American Brass Company

DU PONT
ANNOUNCES

"TRICLENE"
TRICHLORETHYLENE
FINISHING



*A revolutionary new way to finish metals...
based on Du Pont "Triclene" trichlorethylene*



"Triclene" is Du Pont's registered trademark for its trichlorethylene.

Now it is possible to...

CLEAN → PHOSPHATIZE



The production part (shown above) was cleaned, phosphatized and painted in a "Triclene" Finishing unit built by G. S. Blakeslee & Co., Chicago, Ill.

DuPont "Triclene"[®] Finishing provides a new, safer way to finish metals—at substantially lower cost!

It cuts overall costs

Low Investment—"Triclene" Finishing cuts equipment cost up to 50% below conventional finishing methods. Because it is an anhydrous system, parts emerge from cleaning and phosphatizing steps completely dry; the need for costly drying ovens is eliminated. The "Triclene" Painting step also eliminates drying ovens and drip pans normally required following conventional painting. Fewer steps mean that in-process parts inventory and conveyor length can be reduced up to 55%.

Low Operating Costs—"Triclene" Finishing can cut operating costs up to 30%. Reason: It permits close to 100% recovery of paint overspray and excess solvent for reuse. Because "Triclene" Finishing is an anhydrous system, heat requirements are drastically reduced.

Reduced Plant Space—"Triclene" Finishing can be done in less than $\frac{1}{2}$ the space because fewer steps are required. For example: a conventional wet cleaning, phosphatizing and dip-painting system requiring 1960 square feet of floor space could be replaced with a "Triclene" Finishing System requiring only 695 sq. ft.

It increases safety

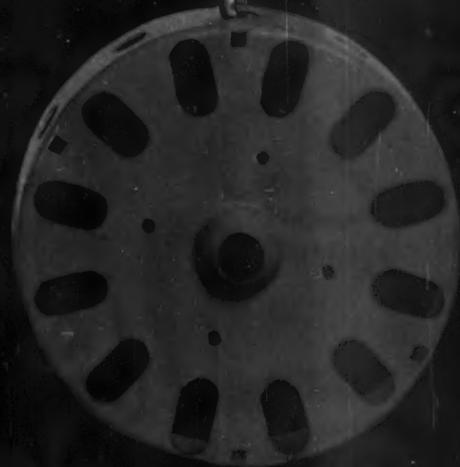
Nonflammable—Trichlorethylene is rated by Underwriters' Laboratories as nonflammable at ordinary room temperatures. Thus fire and explosion hazards are minimized. This means greater plant safety, lower insurance rates and reduced investment in fire protection equipment.

It is flexible

The complete Du Pont "Triclene" Finishing System consists of three basic trichlorethylene-based processes: Vapor Degreasing, Phosphatizing and Painting (see booklet). They can be used in various combinations or incorporated singly into your present finishing system. Various dip or spray cycles can be selected for each of the processes. Both large and small finishing operations can utilize "Triclene" Finishing Processes.

For more detailed information please read the enclosed booklet showing examples of three possible "Triclene" Finishing Systems.

→ PAINT *continuously...*



in a single
medium of
nonflammable
Triclene®
trichlorethylene

more information

Here are the facts on
3 basic Triclene® Finishing Systems

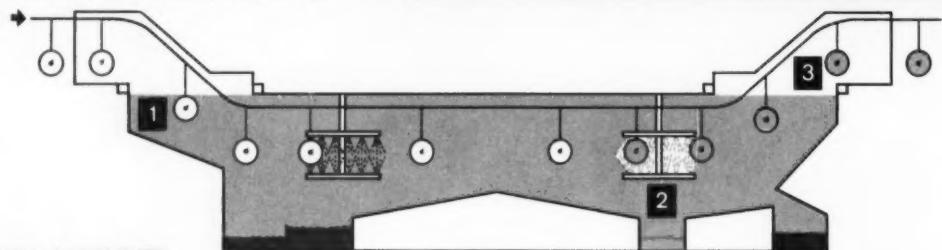
- 1** *Integrated vapor degreasing and nonflammable painting*
- 2** *Vapor degreasing and dry phosphatizing*
- 3** *Vapor degreasing, dry phosphatizing and nonflammable painting*

Now it is possible to ...

CLEAN → PHOSPHATIZE



Du Pont "Triclene"® Finishing System #1



INTEGRATED vapor degreasing and nonflammable painting

The first "Triclene" Finishing System—announced by Du Pont last year—made it possible to integrate cleaning and painting in one compact unit.

HERE'S HOW IT WORKS:

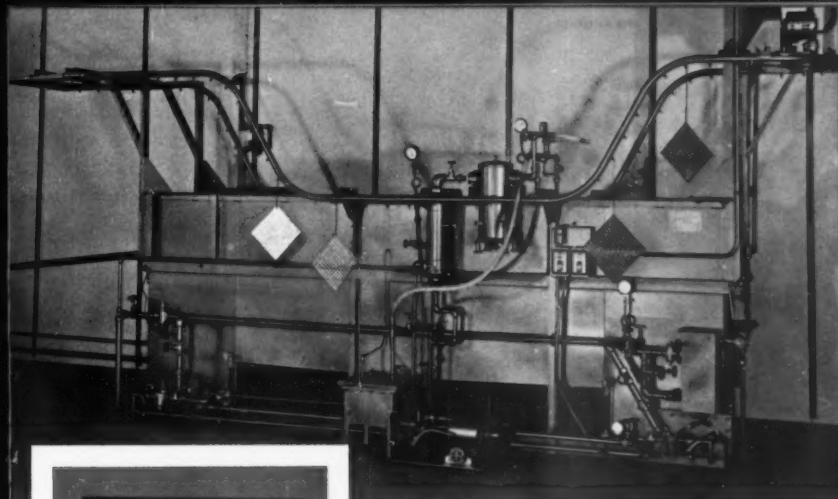
1. A soiled metal part enters the degreasing section of the unit (above) where it is quickly and thoroughly cleaned by trichlorethylene vapor-spray-vapor degreasing.
2. The part moves into the painting section where a new type of industrial paint, thinned solely with nonflammable "Triclene" Paint Grade trichlorethylene, is applied. Spray-In-Vapor method is illustrated; dip painting is also available.
3. The hot, painted part emerges from the unit. Excess solvent quickly evaporates, leaving part completely dry (when lacquers are used), or ready for a short baking step (when curing paints are used).

ADVANTAGES—Integration of cleaning and painting in a single unit drastically reduces equipment size; does away with drip pans; and eliminates the need for a dry-off oven. It also permits close to 100% recovery of paint over-spray and excess solvent for reuse. The amount of "Triclene" solvent recovered from the painting phase will often be enough to run the entire degreasing operation! Nonflammability means greater plant safety, lower insurance rates and less investment for fire protection equipment. These advantages result in substantial cost savings as shown in the comparison at right.

PRESENT STAGE OF DEVELOPMENT—The "Triclene" vapor degreasing and painting system is ready now for general commercial use. A variety of high-quality industrial paints based on "Triclene" trichlorethylene is available. Arrangements can be made to test-paint your parts in demonstration units. (See postcard on back cover.)

→ PAINT continuously...

in a single
medium of
nonflammable
Triclene®
trichlorethylene



Demonstration unit for Degreasing/Spray-In-Vapor Painting now in operation at G. S. Blakeslee & Co., Chicago.



This "Lawn King" lawnmower spreader is now being dip painted commercially using an air-dry "Triclene" thinned paint.

QUALITY OF WORK—Production experience shows excellent appearance and uniformity of film thickness—even on complex parts. Generally, results are equivalent or superior to those obtainable with conventional dip or flow-coat processes.

COMPARE TOTAL COSTS

EXAMPLE:

Work: Steel Shavings
Area Painted: 4,200 sq. ft./hr.

CONVENTIONAL METHOD

Alkali washing, dip
painting, oven drying
steps.

"TRICLENE" FINISHING

Integrated "Triclene"
Degreasing and
Spray-In-Vapor Paint-
ing System.

Total Finishing Cost
\$48.40/hr

Total Finishing Cost
\$38.00/hr

Total Investment Cost
\$169,000
(Approx. Equipment
Cost—\$61,000)

Total Investment Cost
\$94,000
(Approx. Equipment
Cost—\$30,000)

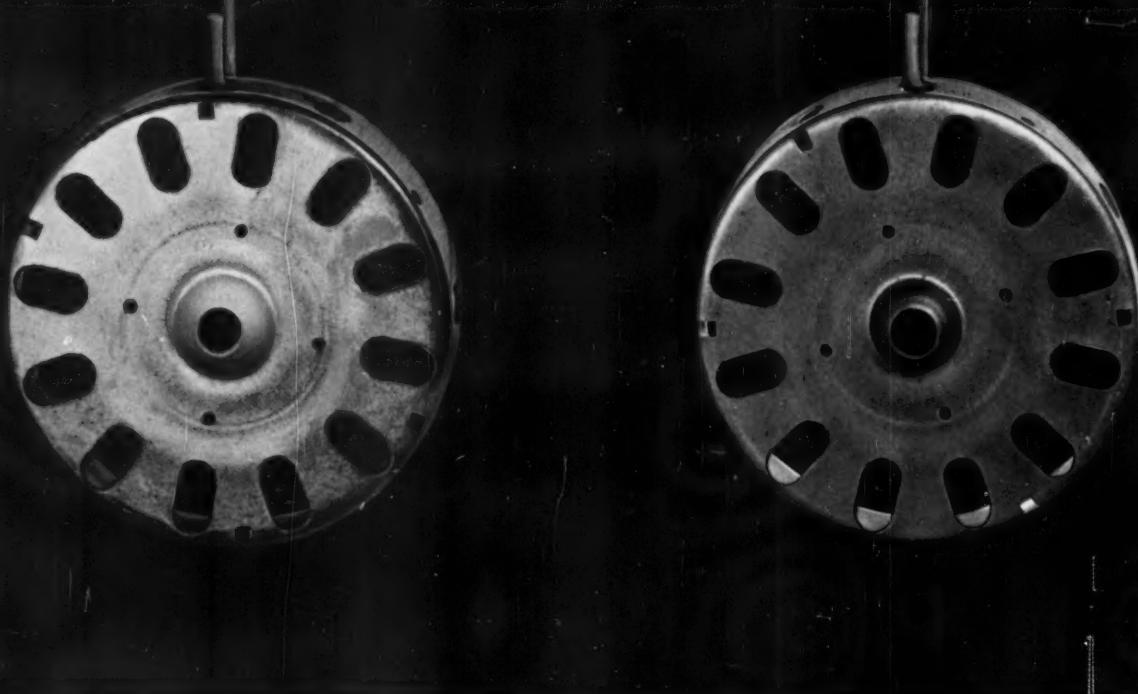
Total Operating Area,
Sq. Ft. 1,640

Total Operating Area,
Sq. Ft. 480

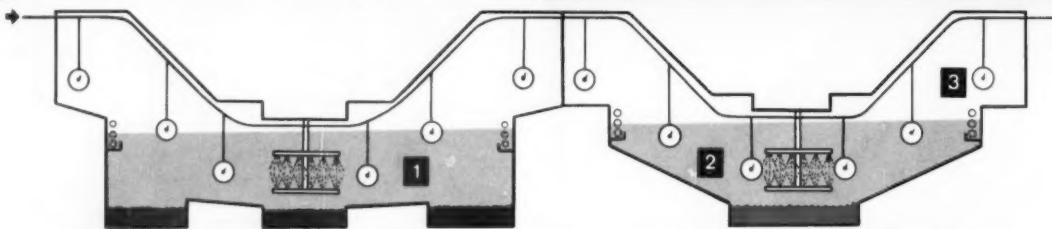
If you're planning to expand or modernize your operation, consider all of the advantages of a "Triclene" Cleaning and Painting System. Du Pont will be glad to help you make a comparative Cost Analysis and to evaluate "Triclene" Finishing for your needs. Fill out postcard on the back page.

Now it is possible to ...

CLEAN → PHOSPHATIZE



Du Pont "Triclene"® Finishing System #2



Vapor degreasing and phosphatizing

PRESENT STAGE OF DEVELOPMENT—

After years of research, Du Pont has developed a new anhydrous phosphatizing method based on trichlorethylene. This recently announced development now makes possible linking of the "Triclene" Degreasing and Painting Processes with a compatible anhydrous phosphatizing process.

Although there are two successful full-scale test installa-

tions now in operation, "Triclene" Phosphatizing will not be commercially available until mid-1960. This will permit Du Pont to complete extensive field testing of the process. Those who wish to explore the possibility of participation in the field test program, or who wish to plan for future modernization, can evaluate "Triclene" Phosphatizing now.

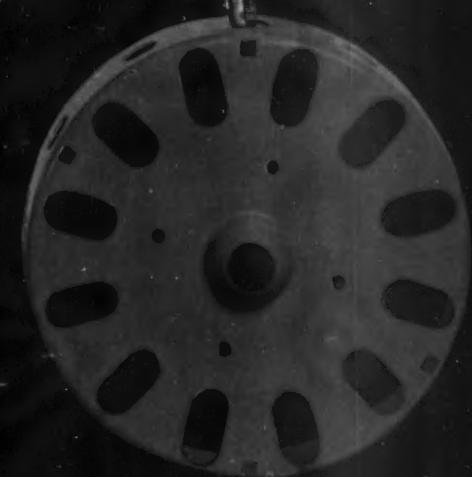
This "Triclene" System combines vapor degreasing and dry phosphatizing; requires just two compact units.

HERE'S HOW IT WORKS: A soiled metal part enters the two-stage system (No. 1 above) where it is thoroughly cleaned by trichlorethylene vapor-spray-vapor degreasing. The part then enters the phosphatizing stage (2) where it is treated in the anhydrous phosphatizing composition. When the phosphatized part emerges from the trichlorethylene

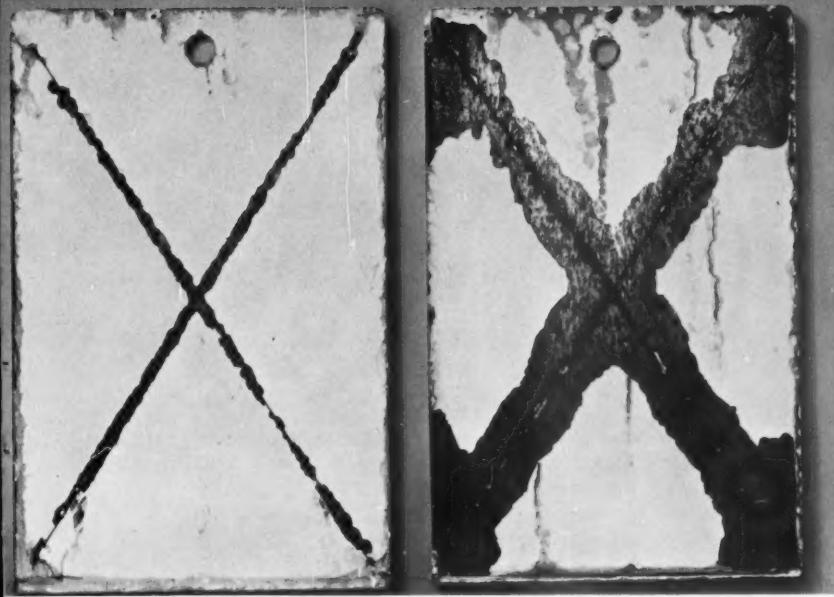
vapor (3) the solvent evaporates and the part is completely dry and ready for "Triclene" Painting, conventional painting, or in-plant storage or shipping.

ADVANTAGES—Anhydrous "Triclene" Degreasing/Phosphatizing takes as little as one-half the time and space of conventional wet systems. Heat requirements are reduced sharply and no dry-off step is needed prior to painting. These advantages result in substantial cost savings as shown in the comparison at right.

PAINT continuously...



in a single
medium of
nonflammable
Triclene®
trichlorethylene



Standard salt-spray exposure test shows quality of "Triclene" phosphatizing: The steel panel on the left was cleaned and phosphatized in a "Triclene" Finishing System and compared with unphosphatized-painted steel after standard salt-spray exposure for 600 hours. As indicated by the minimum corrosion at the scribe mark, the "Triclene" Phosphatized panel shows significantly improved finish performance.

QUALITY OF WORK—"Triclene" Phosphatizing produces an adherent phosphate conversion coating with improved corrosion resistance. In addition, the phosphate coating alone is remarkably resistant to rusting. This unique property benefits the steel fabricator who wishes to store or ship his parts prior to painting.

COMPARE TOTAL COSTS

EXAMPLE:

Work: Steel Shelves
Area Painted: 4,200 sq. ft./hr.

CONVENTIONAL METHOD

Alkali washing, "wet"
phosphatizing, oven
drying steps.

Total Cleaning/
Phosphatizing
Cost \$12.00/hr

Total Investment
Cost \$73,600
(Approx. Equipment
Cost — \$33,000)

Total Operating Area,
Sq. Ft. 760

"TRICLENE" FINISHING

"Triclene" Degreas-
ing / Phosphatizing
System.

Total Cleaning/
Phosphatizing
Cost \$8.30/hr

Total Investment
Cost \$45,500*
(Approx. Equipment
Cost — \$27,000)

Total Operating Area,
Sq. Ft. 456

*The relative cost advantage for the high-
production system illustrated is also attain-
able with smaller operations.

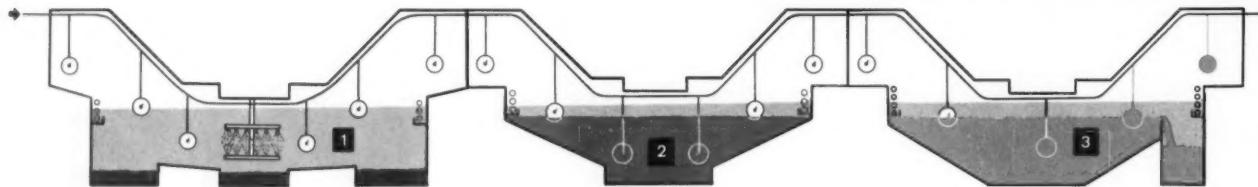
If you're planning to expand
or modernize your operation,
Du Pont will be glad to help you
make a comparative Cost Analysis
and to evaluate "Triclene" De-
greasing and Phosphatizing for
your needs. Fill out postcard on
the back page.

Now it is possible to...

CLEAN → PHOSPHATIZE



Du Pont "Triclene"® Finishing System #3



Vapor degreasing, phosphatizing* and painting

This is the complete "Triclene" Metal Finishing System—the ultimate in processing efficiency.

HERE'S HOW IT WORKS: A soiled metal part enters this three-stage unit (above) and is: (1) thoroughly cleaned by trichlorethylene vapor-spray-vapor degreasing . . . (2) phosphatized during one short immersion in the phosphatizing solution . . . (3) dip painted with "Triclene" Paint Grade trichlorethylene thinned paint. Finished part emerges from the unit completely dry when lacquer is used or ready for a short baking step in the case of curing paints. (Spray-In-Vapor painting, not shown, is available.)

ADVANTAGES—The complete Du Pont "Triclene" Finishing System consists of three compact steps. (If baking enamels are used, a fourth but shortened baking step is required.) Conventional systems take up to 12 steps to do the same job. Nonflammable "Triclene" Finishing cuts in-

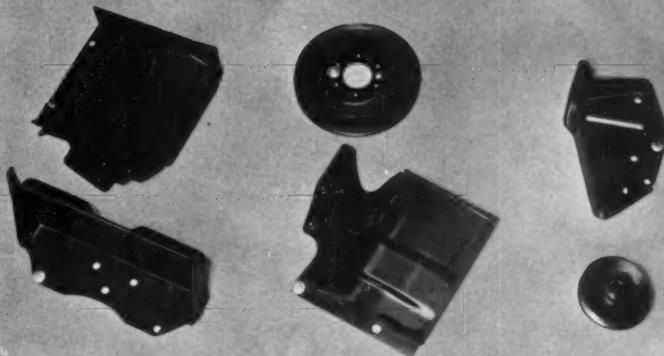
surance and fire protection costs—safeguards plant investment. The lower equipment costs and heat and floor space requirements all result in appreciable savings, as shown in the cost comparison at right.

QUALITY OF WORK—Combining the "Triclene" Processes into one complete system produces a finish which exhibits improved adhesion and corrosion resistance, and excellent appearance.

***Present Stage of Development:** Although a large automotive manufacturer is now using the complete "Triclene" Finishing System, the phosphatizing stage will not be available for wide commercial use until mid-1960. This will permit Du Pont to complete field trials on the "Triclene" Phosphatizing Process. Those who wish to explore the possibility of participation in the Field Test Program, or who are planning future modernization, can evaluate "Triclene" Phosphatizing now. (Fill out postcard on back page.) As stated previously, "Triclene" Degreasing and Painting are commercially available now.

→PAINT continuously...

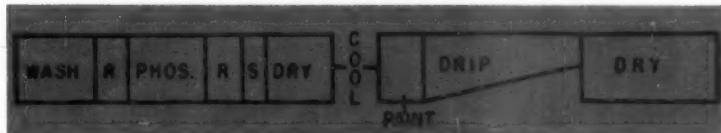
in a single medium of nonflammable Triclene® trichlorethylene



- These automobile engine production parts were vapor degreased, phosphatized and painted in a "Triclene" System similar to the one diagrammed at left.

Compare Operating Areas

CONVENTIONAL METHOD requires 1,960 sq. ft.



"TRICLENE" FINISHING requires 695 sq. ft.



← SAVES OVER ½ THE SPACE →

COMPARE TOTAL COSTS

EXAMPLE:

Work: Steel Shelves
Area Painted: 4,200 sq.ft./hr.

CONVENTIONAL METHOD

Alkali washing, wet phosphatizing, dip painting, oven-drying steps.

Total Finishing Cost ... \$54.30/hr

Total Investment Cost ... \$200,000
(Approx. Equipment Cost—\$73,000)

Total Operating Area,
Sq. Ft. 1,960

"TRICLENE" FINISHING

Vapor degassing, phosphatizing, painting.

Total Finishing Cost ... \$41.70/hr

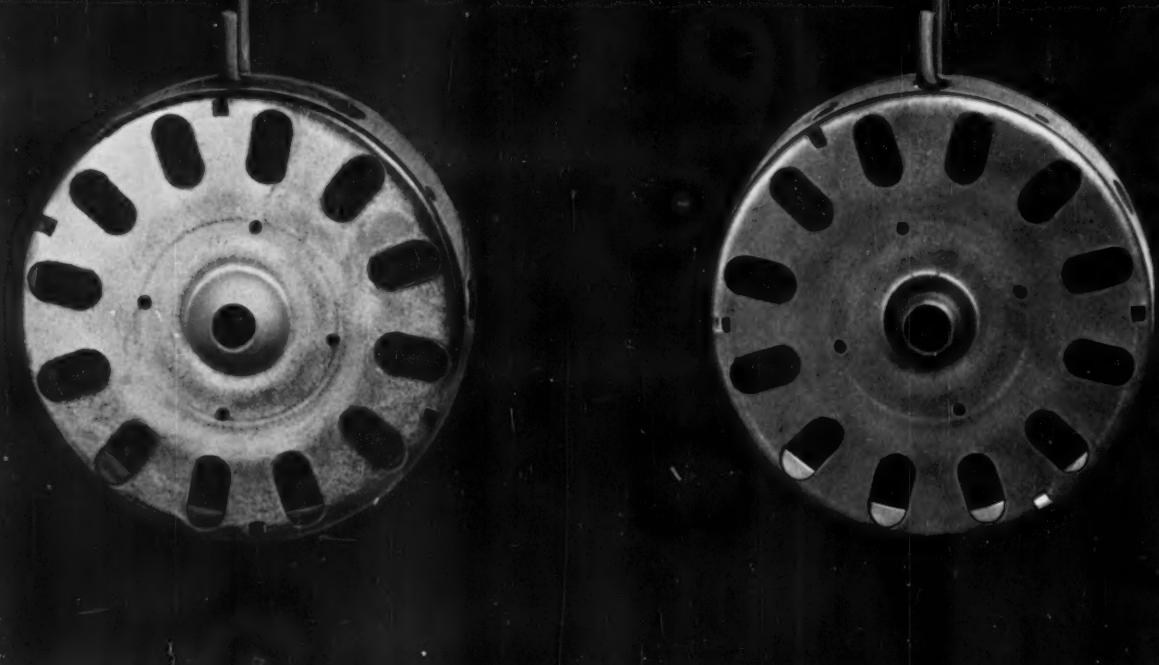
Total Investment Cost ... \$122,000
(Approx. Equipment Cost—\$42,000)

Total Operating Area,
Sq. Ft. 695

If you're planning to expand or modernize your operation, consider all of the advantages of a complete "Triclene" Finishing System. Du Pont will be glad to help you make a comparative Cost Analysis and to evaluate "Triclene" Finishing for your needs. Fill out postcard on the back page.

Now it is possible to...

CLEAN → PHOSPHATIZE



**Here's what to do
if you are
interested in
evaluating
“TRICLENE”®
FINISHING
for your operation**

Fill out and return the postcard at right. If you indicate a general interest, Du Pont will mail you technical literature describing the processes; if you indicate a specific or immediate need for evaluation, Du Pont will initiate the following evaluation program:

1 Finishing Analysis

Du Pont will provide you with detailed process literature and a Finishing Data Sheet which, when filled out by you, will give Du Pont the information needed to answer these three important questions:

1. *Will “Triclene” Finishing maintain or improve your quality standards?*
2. *Is “Triclene” Finishing mechanically applicable in your particular case?*
3. *What cost advantage can you expect to realize from adoption of a “Triclene” Finishing System?*

Preliminary answers to these questions will be presented in a complete *Finishing Analysis* which will include estimates of equipment size and cost plus a confidential “High-Spot” finishing cost comparison of the recommended “Triclene” System with the equivalent conventional system.

→ PAINT continuously...



in a single
medium of
nonflammable
Triclene®
trichlorethylene

2 Product Evaluation and Equipment design

If Du Pont's Finishing Analysis shows that a "Triclene" Finishing System appears applicable to your particular operation, Du Pont will then make arrangements to supply you with panels and parts necessary for you to evaluate the finish produced by the "Triclene" System. Du Pont will then work with the paint and equipment manufacturers to translate laboratory-scale results into a well-designed full-scale system.

3 Help in Start-up

When you install equipment for "Triclene" Finishing you can count on Du Pont assistance through the important start-up period. Du Pont will work with you and your paint and equipment suppliers—will be glad to advise on installation, start-up and operating procedures.

4 Follow-through Service

You can obtain continuing Du Pont service after your "Triclene" System is in operation. A trained Du Pont representative will check with you regularly . . . and will be available when you need technical help.

Fill out this card and mail to Du Pont

I'm interested in evaluating DuPont "Triclene" Finishing for

CLEANING PHOSPHATIZING PAINTING

I would like technical literature describing these processes.

Our Company would consider replacement of existing equipment if we can be shown economic justification. Please send me your Finishing Data Sheet.

We have an immediate need for new finishing equipment to be installed by _____ (target date)

Please have your representative contact me.

Please fill out completely:

Describe parts you finish: _____

Type of process you now use for:

Metal cleaning _____
 Phosphatizing _____
 Painting _____

Name: _____

Position: _____

Firm: _____

Address: _____

City: _____ Zone: _____ State: _____

DuPont makes two trichlorethylene products for use in "Triclene" vapor degreasing and painting

1. "Triclene" D Metal Degreasing Grade trichlorethylene—long recognized as the "standard of the industry". Its consistent high quality means top performance under all operating conditions. Reason: an exclusive combination of neutral stabilizers that resist deteriorating influences, thus assuring longer solvent life. "Triclene" D leaves parts bright and clean, free from deposits, staining, etching, keeps degreaser coils free of sludge; reduces costly downtime and maintenance. "Triclene" D is easily recoverable for reuse.

2. "Triclene" Paint Grade trichlorethylene was especially developed to serve as the thinner for a new class of industrial paints for use in Du Pont's "Triclene" Painting Processes. This special grade of nonflammable trichlorethylene contains a new (neutral) stabilizer formulation which minimizes gelation at process temperature and avoids discoloration of the lightest paint shades. At the same time it maintains the same high standard of stability for which Du Pont's degreasing grade trichlorethylene is well known and can be recovered for reuse in degreasing operations.

NOTE: Du Pont's "Triclene" Phosphatizing Grade trichlorethylene, which is now under field test, will be commercially available in mid-1960 when the phosphatizing process will be ready for general use.

Metal degreasing and paint grades of "Triclene" trichlorethylene are available now from any of these Du Pont distributors:

ARIZONA Western Chemical & Mfg. Co.

CALIFORNIA
Atlas Mfg. & Chem. Co.
Baron Industries
L. H. Butcher Co.
Currier Company
Hansen-Van Winkle-Munning Co.
Chas. F. L'Hommedieu & Sons Co.
Los Angeles Chemical Co.
Reese Supply Co., Inc.
Western Chemical & Mfg. Co.

COLORADO
Braun-Knecht-Haumann Co.

CONNECTICUT
Crane Equipment & Supply Co.
Enthone, Inc.

Hubbard-Hall Chem. Co.
MacDermid, Inc.

FLORIDA
Biscayne Chem. Labs, Inc.
Lenfesty Supply Co.

GEORGIA
McKesson & Robbins, Inc.

ILLINOIS
Central Solvents & Chems. Co.
Dico Co., Ltd.
Industrial Oil & Chem. Co.
McKesson & Robbins, Inc.
The Udyline Corp.

INDIANA
Hoosier Solvents & Chemicals Corp.
Wm. Lynn Chemical Co., Inc.
Stevens Co.

IOWA
Dico Corp., Ltd.
Kennedy & Parsons Co.
McKesson & Robbins, Inc.

KANSAS
McKesson & Robbins, Inc.

KENTUCKY
Dixie Solvents & Chemicals Co.

LOUISIANA
Southern Solvents & Chemicals Co.

MASSACHUSETTS
Borden & Remington Co.
Chemical Sales & Service Co., Inc.
Doe & Ingalls
Eastern Chemicals, Inc.
Hamblin & Hayes Co.
Hewitt & French, Inc.
McKesson & Robbins, Inc.
Textile Aniline & Chem. Co.
Worcester Chemical Distributors, Inc.

MICHIGAN
Carrier-Stephens Co.
Eaton Chemical & Dyestuff Co.
Ecclesone Chemical Co., Inc.
Hansen-Van Winkle-Munning Co.
The Udyline Corp.
Western Solvents & Chemicals Co.
Wolverine Solvents & Chemicals Co.

MINNESOTA
W. D. Forbes Co.
Lyon Chemical Co., Inc.
McKesson & Robbins, Inc.
Worrell Chemical Co.

MISSOURI
Jenkins-Guerin, Inc.
Missouri Solvents & Chemicals Co.

NEBRASKA
McKesson & Robbins, Inc.

NEW HAMPSHIRE
New England Chemical Supply Co.

NEW JERSEY
Brown Chemical Co.
Chemical Solvents, Inc.
Deener & Smith Chemical Co.
McKesson & Robbins, Inc.

NEW YORK
Buffalo Solvents & Chem. Corp.
Duso Chemical Co., Inc.
Eastern Chemicals, Inc.
Empire Electroplating Supply Co.

Enquist Chemical Co.,
McKesson & Robbins, Inc.
Riverside Chemical Co., Inc.
The Udyline Corp.
West Side Corp.

OHIO
Amoco Solvents & Chemicals Co.
The Biron Corp.
Wm. Buchanan Supply Co.
Farley Chemical & Solvents Co.
Industrial Chemical Products Co.
Ohio Solvents & Chemicals Co.
Pel-O-Plate Products
Superior Chemical Products Co.
Thomson Chemical Co.
Tidco Solvents & Chemicals Co.
The Udyline Corp.

OREGON
L. H. Butcher Co.

PENNSYLVANIA
Belico Supplies, Inc.
Carmen-Pittsburgh
Chemclene Corp.
Fort Pitt Chemical Co.
Industrial Solvents & Chemicals Co.
McKesson & Robbins, Inc.
Merchants Products Corp.
George A. Rowley Co., Inc.
Textile Chemical Co.
The Udyline Corp.

RHODE ISLAND
American Chemical Works
Borden & Remington Co.
Brian Supply Co.
Conley & Straight, Inc.
John D. Lewis, Inc.

TENNESSEE
Burkart-Schler Chemical Co.
Ideal Chemical & Supply Co.

TEXAS
Texas Solvents & Chemicals Co.

UTAH
L. H. Butcher Co.

VIRGINIA
Phipps & Bird, Inc.

WASHINGTON
L. H. Butcher Co.

WEST VIRGINIA
Pennsylvania & W. Virginia Supply Corp.
W. T. Rife & Co., Inc.

WISCONSIN
Donald Sales & Mfg. Co.
McKesson & Robbins, Inc.
O'Donohue Sales Co.
Wisconsin Solvents & Chemicals Corp.

FILL OUT REVERSE SIDE AND MAIL

BUSINESS REPLY MAIL

NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID BY

FIRST CLASS

PERMIT NO. 9
WILMINGTON, DEL.

"TRICLENE" FINISHING

TRICHLORETHYLENE



REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING... THROUGH CHEMISTRY

PRINTED IN U.S.A.





**puts on
the finishing
touch**

***Revolutionary new Industrial finish
sprays on...stays on!
all metals! all colors!***

Lowe Brothers Ep-O-Spra looks like special metal finishes but actually surpasses them for durability, economy and ease of application. Resists just about everything—heat, acid, impact and abrasion, to name but a few. Applies without elaborate preparation or special equipment. Check this typical report from a leading manufacturer of outdoor furniture:

"No apparent failure of Ep-O-Spra Brass after 175 day test in Fad-ometer which is equal to 2100 days of outdoor exposure during the

months of June, July and August."

... and Ep-O-Spra is just as much at home on appliances, business machines, metal furniture, outboard motors, bicycles and kitchenware—in fact, almost any product made from treated cold-rolled steel and bonderized metal, or any polished metal surface.

For information and samples, just send the coupon. A Lowe Brothers finishing engineer will visit you and demonstrate how Ep-O-Spra fits into your finishing picture.



Style-tested paints
for Home and Industry

REPRESENTATIVES IN:

Chicago, Ill.	Boston, Mass.
Jersey City, N. J.	Cleveland, Ohio
Pittsburgh, Pa.	Rochester, N. Y.
Dayton, Ohio	Columbus, Ohio
Milwaukee, Wis.	Indianapolis, Ind.
Cincinnati, Ohio	Detroit, Mich.
Springfield, Mass.	Philadelphia, Pa.

**LOWE BROTHERS
INDUSTRIAL
FINISHES**

Quality unsurpassed since 1870

The Lowe Brothers Company
Dayton 2, Ohio

(MF-12)

Please have my nearest Lowe Brothers Finishing Engineer call on me as soon as possible.

NAME _____

TITLE _____

FIRM NAME _____

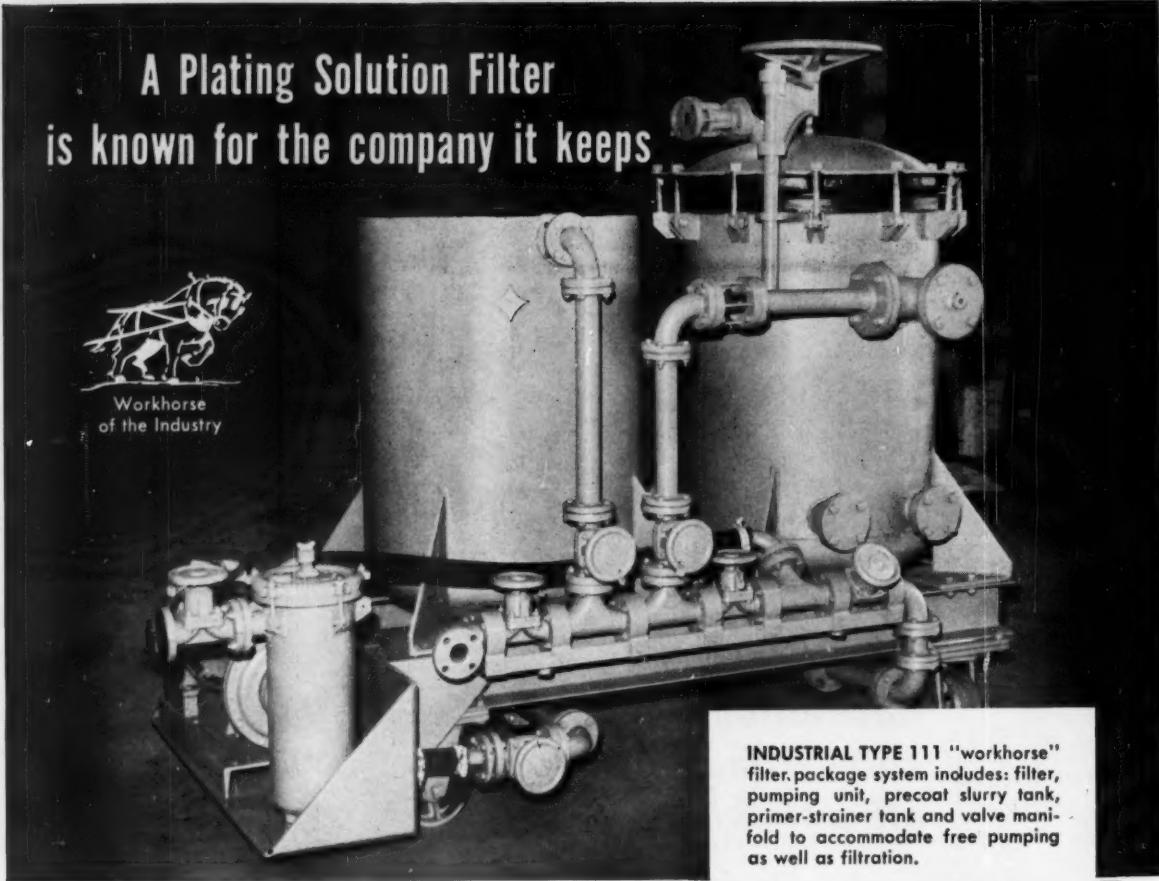
ADDRESS _____

CITY _____ ZONE _____ STATE _____

A Plating Solution Filter is known for the company it keeps



Workhorse
of the Industry



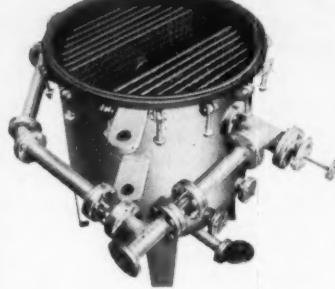
...and this one keeps company with those who demand lowest cost per gallon of filtrate.

This is the Type 111 Standard *Industrial* vertical leaf pressure filter. It is popular, preferred and keeps good plating company because it gives plating people what they want.

Its sound basic design is readily adaptable to literally hundreds of modifications—permitting compatibility of filter to system, high performance potential and lowest possible cost per gallon of filtrate. Type 111 is furnished with top outlet leaves and can be equipped for rapid air-wash cleaning. It can be used for any acid or alkaline plating solution, and is available in 25 standard sizes—ranging in flow capacities of 100 to over 30,000 gph. Smaller units are semi-portable. Larger units are stationary.

Bulletin 100EP gives full details on Type 111 and other *Industrial-Engineered* systems which have become *industry standards* because of their versatility and adaptability . . . for the filtering job at hand. Write for a copy.

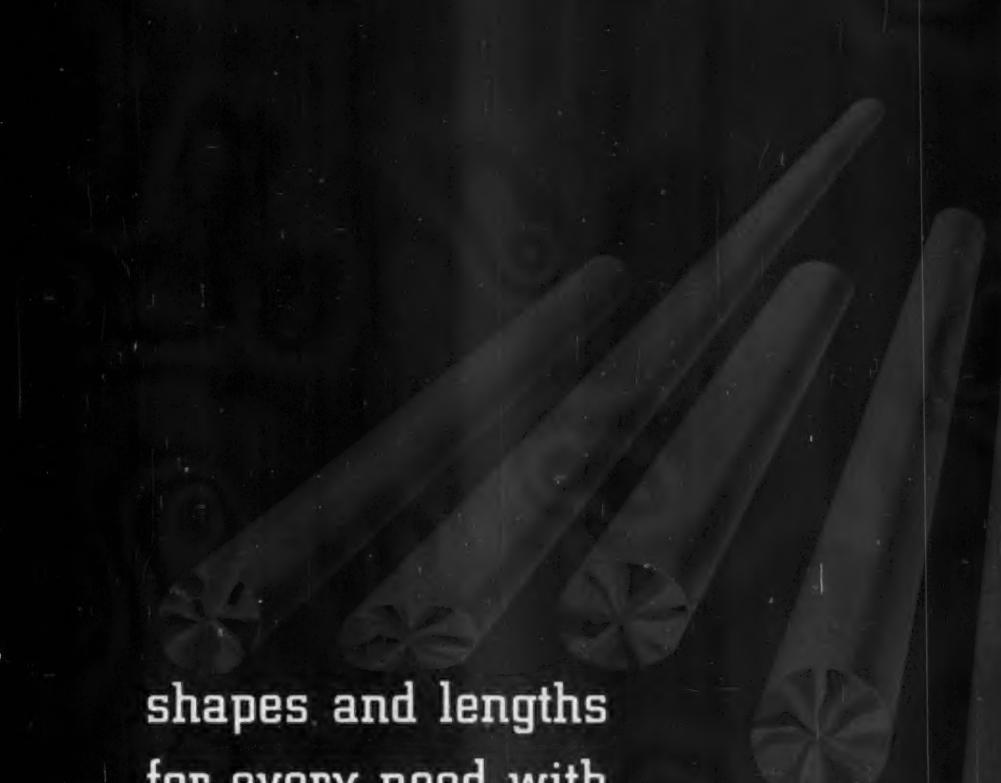
INDUSTRIAL TYPE 111 "workhorse"
filter package system includes: filter,
pumping unit, precoat slurry tank,
primer-strainer tank and valve mani-
fold to accommodate free pumping
as well as filtration.



COVER REMOVED: Photo shows lock-up of two banks of seven leaves and interconnected double outlet with sight glasses.

INDUSTRIAL

INDUSTRIAL FILTER & PUMP MFG. CO.
5906 Ogden Avenue, Cicero 50, Illinois



shapes and lengths
for every need with
OFHC ANODES

If you have been searching for a *really long* anode that's ideal for close spacing, ask your OFHC Anode distributor about the 1½ x 3-inch oval, available up to 8 feet long! Or if you're using anode baskets, ask him about replacing forged balls with short slugs of OFHC 2-inch rounds. Whatever your anode shape requirements might be, you'll find an OFHC Anode that fits precisely, and in any length to 96 inches:

- 3" round • 2" x 3" oval • 2" round
- 1½" x 3" oval • 1½" x 5" flat

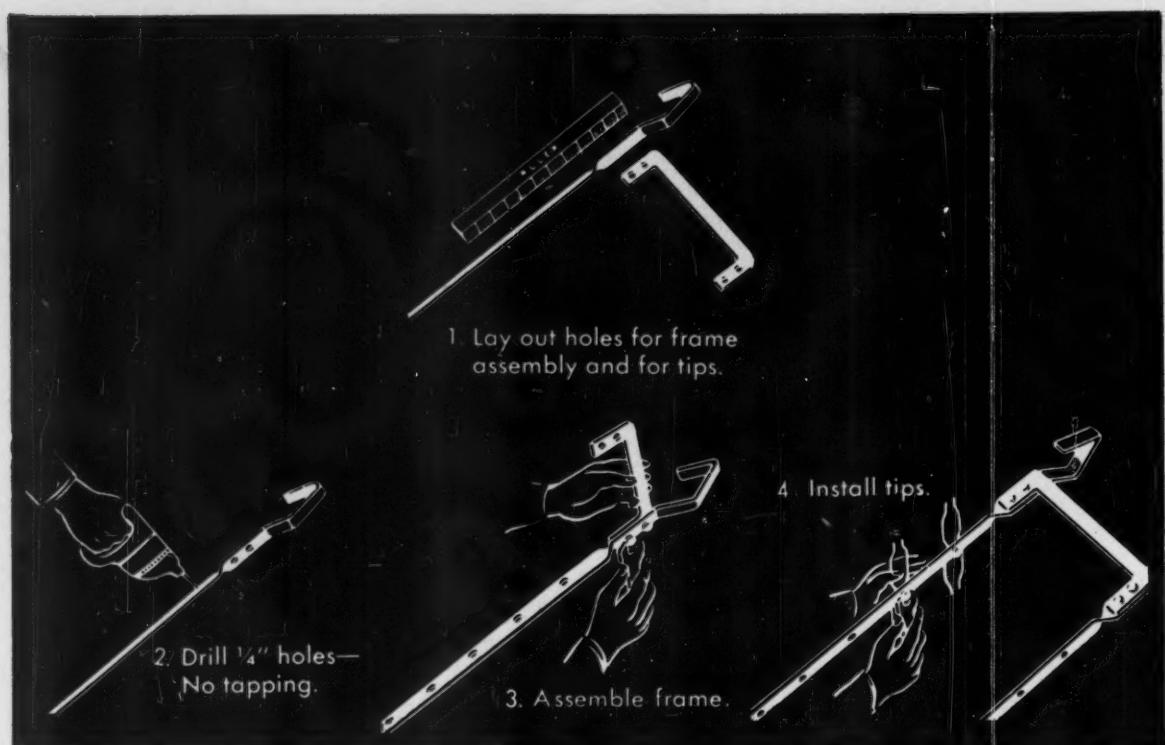
And no matter which OFHC Anode shape you specify, you will be ordering the purest copper commercially produced. OFHC Anodes are 99.99+% copper, completely free of oxides, uncontaminated by residual deoxidants. For free assistance in putting OFHC quality to work—in the shape and length you need—contact your OFHC Anode distributor, or AMCO Technical Service Section directly.

AMCO DIVISION

American Metal Climax, Inc.
61 Broadway, New York 6, N.Y.



OFHC Anodes—Made Only by American Metal Climax—are Sold by Leading Plating-Supply Distributors Everywhere.



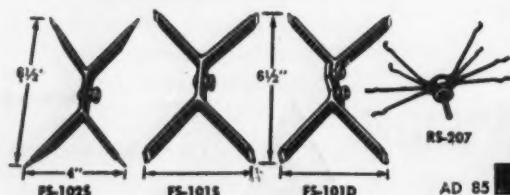
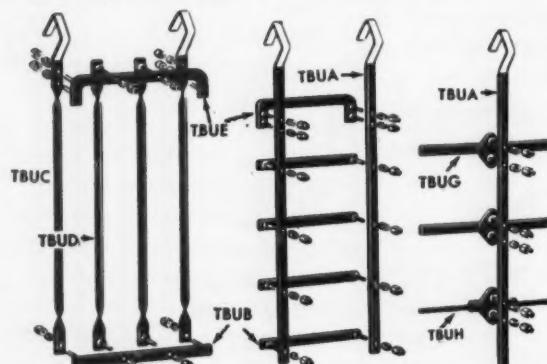
Pre-Insulated Parts are quickly assembled

Patent No. 2,820,757

BELKE THINKER BOY RACKS

Convert Waste into Profit

You can assemble needed rack styles
with tips spaced to fit the work



FLEXIBILITY UNLIMITED

Broken tips are
easily replaced.

You can
change tips

Change tip spacing.

Convert rack frames
to other styles as needed



Send for the Thinker Boy Instruction Manual.

See how easy it is to assemble completely insulated racks of your own design. Get acquainted with the marvelous assortment of THINKER BOY Tips. The more you THINK with Thinker Boy the more you save.



MANUFACTURING COMPANY
947 N. Cicero Ave., Chicago 51, Ill.

AD 85

EVERYTHING FOR PLATING PLANTS



LEA

ABRASIVE FINISHING METHODS

STAINLESS STEEL and STEEL

STAMPINGS • CASTINGS • FORGINGS • SPINNINGS

Stainless steel is harder than carbon steel commonly used for forming and on most occasions more time is required to produce a selected finish on stainless steel than the same finish on steel. However, for normal application, the same general procedures are utilized.

Although much progress has been made in the finishing of stainless steels and carbon steel, the production of mirror and high luster finishes is still not easy and the costs are fairly high. On the other hand, attractive semi-bright satin and butler finishes can be obtained at a cost no greater than that required for producing this same finish on other metals. Today, satin or butler finishes are produced on a wide variety of steel or stainless steel articles, the choice being due to the great difference in the cost of production between this type of finish and the high luster finish. Some of these steels, both carbon and stainless, undergo work hardening and physical transformation at relatively low temperatures, thereby complicating polishing and buffing operations.

POLISHING... Polishing is usually done on sewed muslin, canvas, solid leather, sheepskin or felt wheels or abrasive belts at speeds of 6000-8000 sfm. Sometimes five or six polishing operations are employed. The shallower the surface imperfections are, the less coarse need be the first wheel operation and the easier the subsequent removal of scratches left by this wheel. On fairly good surfaces, only one or two of the polishing wheel operations should be necessary. For some types of stainless steel and steel products these operations may be considered a final finish. Polishing wheels may be prepared with Lea Gripmaster Polishing Wheel Cement or Lea Plasti-Glue and loose abrasives. Liquid abrasive mixtures such as Leabrament or Lea Plasti-Brade are also used in preparing polishing wheels. Lubrication or greasing a polishing wheel or belt can be done with Lea Lubar (bar lubricant) or Lea Liqualube (liquid lubricant).

FLEXIBLE POLISHING... On curved or irregular surfaces of steel, or stainless steel, flexible polishing with Grade "E" or Grade "E2" Lea Compound at 6000 sfm on a sewed buff sized with Ad-Lea-Sive is used in place of conventional fine set-up wheels to prepare the surface for subsequent cut-down buffing.

SATIN FINISHING... To produce a final satin finish on articles fabricated from rolled stainless steel with good surface characteristics, Grade "E" or Grade "N" Lea Compound is used on a loose or pocketed type muslin buff at 4500-5500 sfm. In fabricating products from pre-finished stainless steel having standard mill finishes,

welded or formed areas sometimes require a coarse satin finish to simulate or blend in with the mill finish. Lea Greaseless Compound Grades 1-K-2 or 1-K-7 are used with Lea String Wheels to simulate #3 or #4 mill finishes.

BUTLER FINISHING... To produce this final finish showing no surface defects, use Grade "B-31" Lea Compound with Grade 316 Learok as a lubricating agent on a sewed, loose or pocketed type muslin buff at 5500 sfm.

BRIGHT FINISHING—(Bar Compositions)... After intermediate flexible polishing with Lea Compound, a bright-finish is produced with Grade 306 or 316 Learok on a pocketed type buff at 10,000 sfm. For color, use Grade 302C or 309 Learok on the same type wheel and at the same speed.

BRIGHT FINISHING—(Liquid Compositions)... After intermediate flexible polishing with Lea Compound or if the stainless steel has a surface in fairly good condition to serve as a base for bright finishing, Lea Liquabrade is used.

Grades FH77J or UF47J Liquabrade will cut down minor imperfections and give some color. Grade 7370 Liquabrade is for cut and color and recommended where fairly bright finishes are required.

Grade UH20A Liquabrade gives the highest color and is generally used for the last buffering operation.

Speeds of 8000 to 10,000 surface feet per minute are recommended. Ventilated, sewed or loose buffs can be used.

BLENDING AND SIMULATING MILL FINISHES ON STAINLESS STEEL

One current production method for blending in weld marks and removal of tool or die marks is as follows:

The weld bead is first ground down with a #4 grit disc, then with a portable belt machine using an 80 grit belt. The area around the weld is then finished to simulate a #4 mill finish and is produced with Grade 1-K-2 coarse grit Lea Compound on a 6" dia. string wheel operated by a heavy duty flexible shaft machine. Lea Compound is applied to the string wheel and allowed to dry approximately 5 minutes. The string wheel is then placed against the surface of the stainless steel in a straight line motion to keep the

scratch pattern as uniform as is possible. The final operation involves the use of a polishing log made up of Lea String Wheels making a total face width of approximately 24". These string wheels are mounted on a shaft with ball bearing handles. After Grade 1-K-2 is applied to the polishing log, coated thoroughly and dried adequately, two men hold the polishing log and satin finish the entire surface on large areas of the stainless steel item in one uniform operation. This Lea Satin Finish produced with 1-K-2 Lea Compound directly on the original 2-B mill finish simulates quite closely the desired #4 mill finish. A periphery speed of 1350 surface feet per minute is used.



Burring, Buffing, Polishing, Lapping, Plating and Spray Finishing
Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions. Manufacturers of Lea Compound and Learok. Industry's quality buffing and polishing compounds for over 30 years.

THE LEA MANUFACTURING CO.
16 CHERRY AVE., WATERBURY 20, CONN.

Lea-Michigan, Inc., 14459 Wildemere Ave., Detroit 38, Mich.
Lea Mfg. Company of Canada, Ltd., 1236 Birchmount Road, Scarborough, Ontario, Canada
Lea Mfg. Company of England, Ltd., Buxton, Derbyshire, England
Lea-Ronal, Inc., Main Office and Laboratory, 139-20 109th Ave., Jamaica 35, N. Y.
Manufacturing Plant: 237 East Aurora St., Waterbury 20, Conn.

Are you interested in plating specialties? SEE THE OTHER SIDE OF THIS INSERT

ABRASIVE FINISHING
STAINLESS STEEL & STEEL

Tailored cyanide copper processes



*...there's a specific
Lea-Ronal
copper process to meet
your own
exacting requirements*

Over the years Lea-Ronal has gained world-wide recognition for its research on cyanide copper plating. From this research and development have come numerous processes, each with its own characteristics that make it outstanding for a specific type of operation. Every member of this Lea-Ronal family of Cyanide Copper Processes has been thoroughly production-tested and has been instrumental in improving the quality and production of the user's plating operation.

Any order for a Lea-Ronal Process carries with it plus values in experienced technical service and know-how.



Lea-Ronal Inc.

Sales and Manufacturing Plant:
237 East Aurora Street, Waterbury 20, Conn.
Main office and Laboratory:
139-20 109th Avenue, Jamaica 35, N. Y.

for bright
high speed
copper

for
buffable
copper

for
hiding
imperfec-
tions

for micro-
leveling and
lustre

for
high rates
of deposition
plus micro-
leveling

for leveling
plus high rates
of deposition

COPPER-GLO

For plating buffed zinc die castings or steel where maximum leveling or hiding is not a factor.

A full bright high speed cyanide copper that has become the industry standard. Through continued research this process has been constantly improved to give trouble free bright high speed operation.

CUPRALL

A lustrous, ductile, buffable copper than can be plated at high speeds. Because of these characteristics and its exceptional tolerance to impurities, this bath has become the standard for such operations as bumper refinishing.

Q-STRIKE

A cyanide copper strike developed to aid in "hiding" surface imperfections that are not covered by conventional strikes or bright copper processes. Will increase hiding and leveling when used as a strike prior to bright nickel.

Q-LEVEL

A new improved economical and simple cyanide copper process that offers a definite degree of leveling or hiding without employing current reversal cycles. Imperfections in castings can be partially or completely hidden (Leveling is achieved on surface roughness not exceeding 10 RMS).

AIR-Q-LEVEL

A Q-Level Bath specifically designed for air agitation. Offers all the advantages of the Q-Level Process plus increased rates of deposition, and excellent metal distribution.

PR-Q-LEVEL

A Q-Level Bath designed to operate with Periodic Reverse. In addition to the high rates of deposition, macro-leveling as well as micro-leveling can be achieved. Process is simple, economical, completely stable with no deterioration of brighteners over prolonged operating periods.

WRITE OR PHONE:

THE LEA MANUFACTURING CO. 16 CHERRY AVE., WATERBURY 20, CONN.
THROUGH WHOM THESE CYANIDE COPPER PROCESSES ARE EXCLUSIVELY MARKETED.

Note: The above Lea-Ronal Cyanide Copper Processes are covered by patents or pending patents.

Are you interested in Buffing, Polishing and Burring Specialties? SEE OTHER SIDE OF THIS INSERT.



Know about Sandoz "bread and butter" dyes?

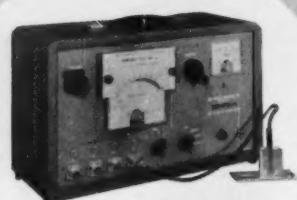
Trouble-free! Long experience in solving the problems of color anodizers enables Sandoz to assist you in selecting dyes for anodized aluminum which are trouble-free. Here are some of the "bread and butter" Sandoz dyes that require a minimum of control and provide excellent stability in the standing bath, thus resulting in far superior tank life:

Aluminum Gold S	Aluminum Green AX	Aluminum Bordeaux 2R
Aluminum Copper BF	Aluminum Blue A	Aluminum Orange 3A
Aluminum Red RN	Aluminum Violet 3D	Aluminum Yellow 4A
Aluminum Orange 2B	Aluminum Black BK	Aluminum Blue 4A
Aluminum Yellow D	Aluminum Gold EA	

For detailed information and color chips, call or write: SANDOZ, INC., Aluminum Department, 61 Van Dam St., New York 13, N.Y. ALgonquin 5-1700.

S A N D O Z
THINKS AHEAD WITH COLOR





**DERMITRON
NON-DESTRUCTIVE
COATING THICKNESS
TESTER**

MEASURES METALLIC AND NON-METALLIC COATING THICKNESS

The DERMITRON instantly and accurately provides direct readings of metallic and non-metallic coatings and films. It is widely used and recommended for measurement of such coatings as: CADMIUM or ZINC on steel; SILVER on brass; ANODIZING, HARDCOAT, PAINT on aluminum, magnesium, etc.

Very simple to operate, the DERMITRON is compact, offering portability for both laboratory and production use. Four patented measuring probes are available for extra-wide thickness ranges from thick to thin deposits and enable measurements on small areas and previously inaccessible areas. You can rely on the DERMITRON NON-DESTRUCTIVE TESTER for any application where coating thickness must be controlled. Write for current bulletins and price list.



**PERIODIC-REVERSE
AND CURRENT-INTERRUPTION
UNITS**

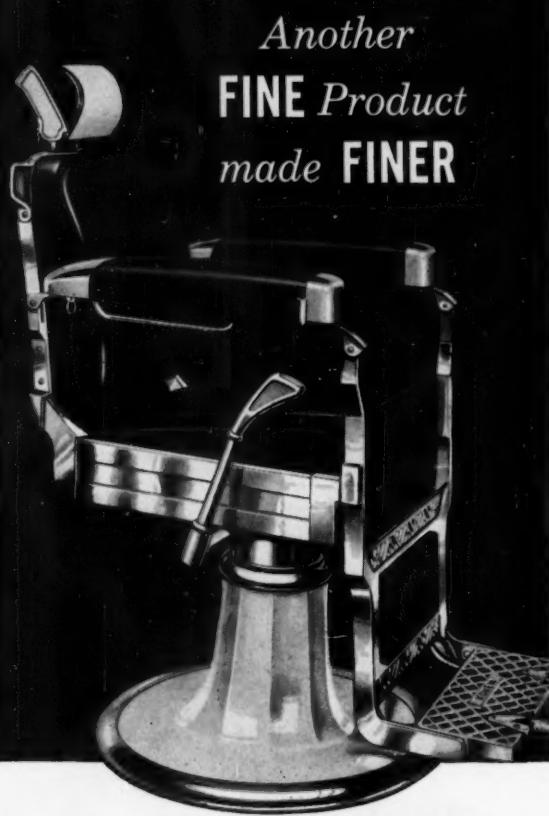
PERIODIC REVERSE UNITS are used with ALKALINE DERUSTING and DESCALING processes for more efficient and effective cleaning operations. Write for Bulletin PR-AD-1.

PERIODIC-REVERSE and CURRENT-INTERRUPTION UNITS—for PLATING of SILVER, COPPER, GOLD, BRASS, etc., this fine electronic equipment saves time, money and improves quality. It makes deposits smoother . . . faster . . . brighter . . . easier to polish . . . less porous . . . more uniform. And it's extremely simple to install and operate. Write for current Bulletin PR-3 and prices.

All requests for complete details are processed quickly.

UNIT PROCESS ASSEMBLIES, INC.

61 East Fourth Street • New York 3, N.Y.



with the PARAMOUNT Finishing Touch

"A superior finish is essential on the castings for our chairs," says Koken Companies, Inc., St. Louis, leading manufacturer of barber chairs.

"For appearance they must be finished flat with no rounding of edges. We do it quickly and easily by using Paramount Felt Wheels and 150-220 oxide grit. Paramount Wheels are ideal because they hold the compound well, follow flat surfaces easily and produce a finish more quickly than any other wheels we have used."

Your products deserve the fine finish only Paramount Wheels can produce. Learn more about their advantages —

call your Paramount Supplier today!

Paramount



Felt Wheels
Bobs, Sheet Felt

Bacon Felt Co.
437 West Water St., Taunton, Mass.

WORLD'S BEST WAY TO CLEAN METAL!



It's the Acoustica ultrasonic way! The metal is immersed in a cleaning solution, activated in an Acoustica ultrasonic tank. Almost instantaneously, the fluid bubbles with powerful "cavitation" action. "*Silent sound*" is at work! In seconds the dirt has disappeared—every particle of it, down to the invisible dust that escapes the human eye. *It has been blasted away ultrasonically!* There is no laborious, time-consuming scrubbing, no disassembling—maintenance costs are at a minimum. Results are better, faster, cheaper. Definitely the world's best way to clean metal is the Acoustica ultrasonic way!

Acoustica is the recognized leader in quality ultrasonic cleaning equipment, the sole producer of the *Multipower* transducer. An Acoustica *certified* ultrasonic application is your assurance of maximum cleaning efficiency!

Acoustica Associates, Inc., Fairchild Court, Plainview, N. Y., 10402 Aviation Blvd., Los Angeles, Calif.

acoustica
THE GREATEST NAME IN ULTRASONICS

Rhodium

ELECTROPLATING SOLUTIONS



Backed by 58 Years

of Specialization

Technological knowledge acquired through many years of experience, plus special processes and equipment, assure the high quality of our Rhodium Plating Solutions.

Recommended for contact surfaces of switches, wave-guide parts and other electrical applications, such as printed circuits...Can be applied in extremely heavy deposits, up to 100 milligrams per square inch.

Rhodium plating provides the advantages of whiteness, lustre and corrosion resistance of a precious metal.

Consult our staff
about plating problems.



SIGMUND COHN MFG. CO., INC.

121 SOUTH COLUMBUS AVENUE • MOUNT VERNON, NEW YORK

BOOKS FOR THE PLATER

METALLIZING NON-CONDUCTORS

By SAMUEL WEIN



64 pages
5½ x 7½ paper cover

The present work deals with every known method for "metallizing" or the deposition of metals by electrolysis (plating) on non-conductors. It is divided into several sections, i.e., those processes which use chemical, mechanical and physical methods for treatment of surfaces for metallizing. In these groups the specific methods are chronologically reviewed and so the reader can very readily get a better idea of the progress made by the various workers in these arts. At the end is an alphabetical listing of contributors to the art, so that the serious workers can refer to the original sources of the information given in the text by Mr. Wein.

The text is prepared in a practical fashion so that the formulas given will be of material use and is the result of literature collected by the author for more than 25 years and which has been in use by a number of industrial concerns here in the United States and abroad.

PRICE \$2.00

Dictionary of Metal Finishing Chemicals

By HALL and HOGABOOM



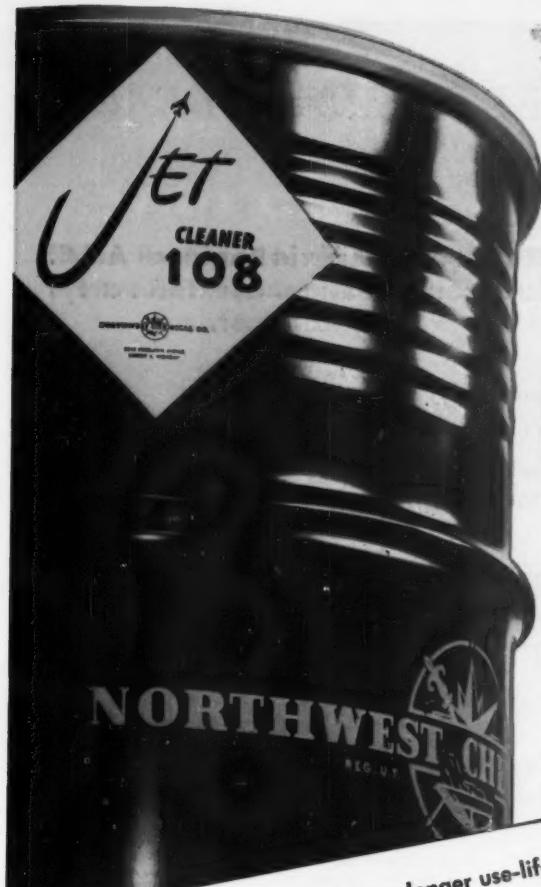
129 pages
5½ x 8½ cloth bound

This volume fills the need in the metal finishing field for a handy source of information concerning the chemicals employed. The technical and common names are listed in alphabetical order together with information as to physical appearance, chemical formula, molecular weight, melting and boiling points, and solubility. Available grades, types and sizes of shipping containers are also given, all of which are of help in identifying the contents of unlabelled packages which are found in most plating rooms. A special section contains tables of degrees, Baumé and specific gravity for solutions of a great many salts. Various solutions and dips employed in the finishing department may be easily controlled by the use of a hydrometer and these tables. The authors, editors of the *Metal Finishing Guidebook-Directory* and associate editors of *Metal Finishing*, as a result of their familiarity with the requirements of the industry, have compiled a reference volume which belongs on the shelf of every metal finisher.

PRICE \$3.00

BOOK ORDERS PAYABLE IN ADVANCE

METAL FINISHING
381 Broadway, Westwood, N. J.



ANNOUNCING

JET 108

AN EXTREMELY LOW-FOAMING GENERAL USE
SINGLE OR MULTIPLE STAGE SPRAY CLEANER
FOR BETTER RESULTS AT LOWER COST!

- Gives up to three times longer use-life than competitive products.
- Better cleaning through unusually potent penetrants, surfactants and dispersing agents.
- Carries heavy dirt load without redeposition.
- Higher the concentration, lower the foaming.
- For use on all ferrous and non-ferrous metals except aluminum.

Got a problem? Let Northwest's Cleaning Specialists help you.
Licensed Manufacturers {

- Used at 100° to 140°F temperatures.
- Easily removes drawing compounds, oils, and greases.
- An effective rust-inhibitor for in-plant use.
- Ideal for use following soak cleaners.
- An easily handled, moist, granular alkali base material.
- Non-Toxic, dustless, non-caking.
- No disposal problem.

Alert Supply Co., Los Angeles, California
Armalite Company, Ltd., Toronto, Canada

NORTHWEST

9310 ROSELAWN



CHEMICAL COMPANY

DETROIT 4, MICHIGAN

ELECTROPLATERS' TO MEET in MIAMI BEACH

JANUARY 15-16, 1960



The Saxony is located in the very heart of Miami Beach on the ocean front. This photo shows the surrounding area including the Indian Creek Canal, Biscayne Bay, and the new Causeway leading to Miami.

Arrangements have been made for those arriving as early as January 12th to pay the lower convention rates as follows:

Single room, either single or double occupancy \$18.00 per day

Triple room, three separate beds in a room \$24.00 per day

Two room suite, living room and bedroom \$36.00 per day



Outdoor Terrace Night Club where banquets are held under the stars.

Second Annual Dixie Regional A.E.S. Educational Session, Cocktail Party, and Banquet.

PROGRAM

JANUARY 15

9:00 A.M.—Registration at the Saxony Hotel, On the Ocean at 32nd Street. Telephone JEFFERSON 8-6811.

9:30 A.M.—Tour of the National Air Lines Overhauling facilities at the International Airport, including aircraft and engine maintenance and repair, and the inspection of either a Boeing 707 or a Douglas DC-8.

12:30 P.M.—Luncheon and fashion show for the ladies in the Saxony's La Petite Ballroom. The fashion show will be presented by leading Miami Beach specialty shops.

1:30 P.M.—Technical Program: Speakers will be: Al Korbelaik of Sel-Rex, Dr. M. M. Beckwith of Harshaw, Dr. Sam Spring of Kelite, Bruce Scott of Wright Aero Div. of Curtiss Wright, Dr. Henry Kellner of Lea-Ronal, and Dr. Seyb of Metal & Thermit.

7:00 P.M.—Optional night club tours at the special off-season rate of \$12.00 per person. This tour consists of a cocktail, full course dinner at the Lucerne Hotel, featuring the Havana Mardi Gras, plus one drink and floor show at one of the following: Diplomat, Carillon, Eden Roc, Deauville, or Americana.

JANUARY 16

9:00 A.M.—Second half of the technical session.

10:00 A.M.—Guided tour of Miami Beach for the ladies by land and water including a two-hour stop over at the Seaquarium.

2:00 P.M.—Annual meeting, Dixie Regional Delegates.

6:15 P.M.—Saxony, Cocktail Party.

7:00 P.M.—Banquet, floor show and dance — La Petite Ballroom and Ocean Terrace.

The registration fee for the two-day meeting will depend upon proceeds from the advertising program, but should not exceed \$15.00 per person single, or \$25.00 per couple.

USE THE COUPON BELOW FOR ADVANCE REGISTRATION

**TO: M. H. "Duke" Dent
4798 North West 5th Street
Miami 44, Florida**

I am planning to attend the Second Annual Dixie Regional Conference in Miami Beach, January 15-16. Please make a reservation for me at the Saxony Hotel. My party will consist of _____.

Name _____

Address _____

Company _____

City _____ Zone _____ State _____

These pellets are packed solid with chromium plating benefits

*...and pour
with no dust*

less splash

and dissolve readily

New packaging...new handling ease added to Unichrome SRHS® Chromium's operating advantages



Now in pelletized form, Unichrome SRHS® Compounds still contain the same ingredients. They still give you the higher plating speed...the simplicity of self-regulating solutions...the wider bright plate range...and the better results being enjoyed by so many platers.

But pelletizing has made them even easier to work with. The pellets can be poured or shoveled without dust. They won't cake in partly used drums; nor will the salts stick to sides of the lined container. They eliminate hazard of caked masses of compound dropping into the bath and splashing workers.

You'll find the new disposable fibre drums easier to open and close. Being lighter, they also save on shipping costs.

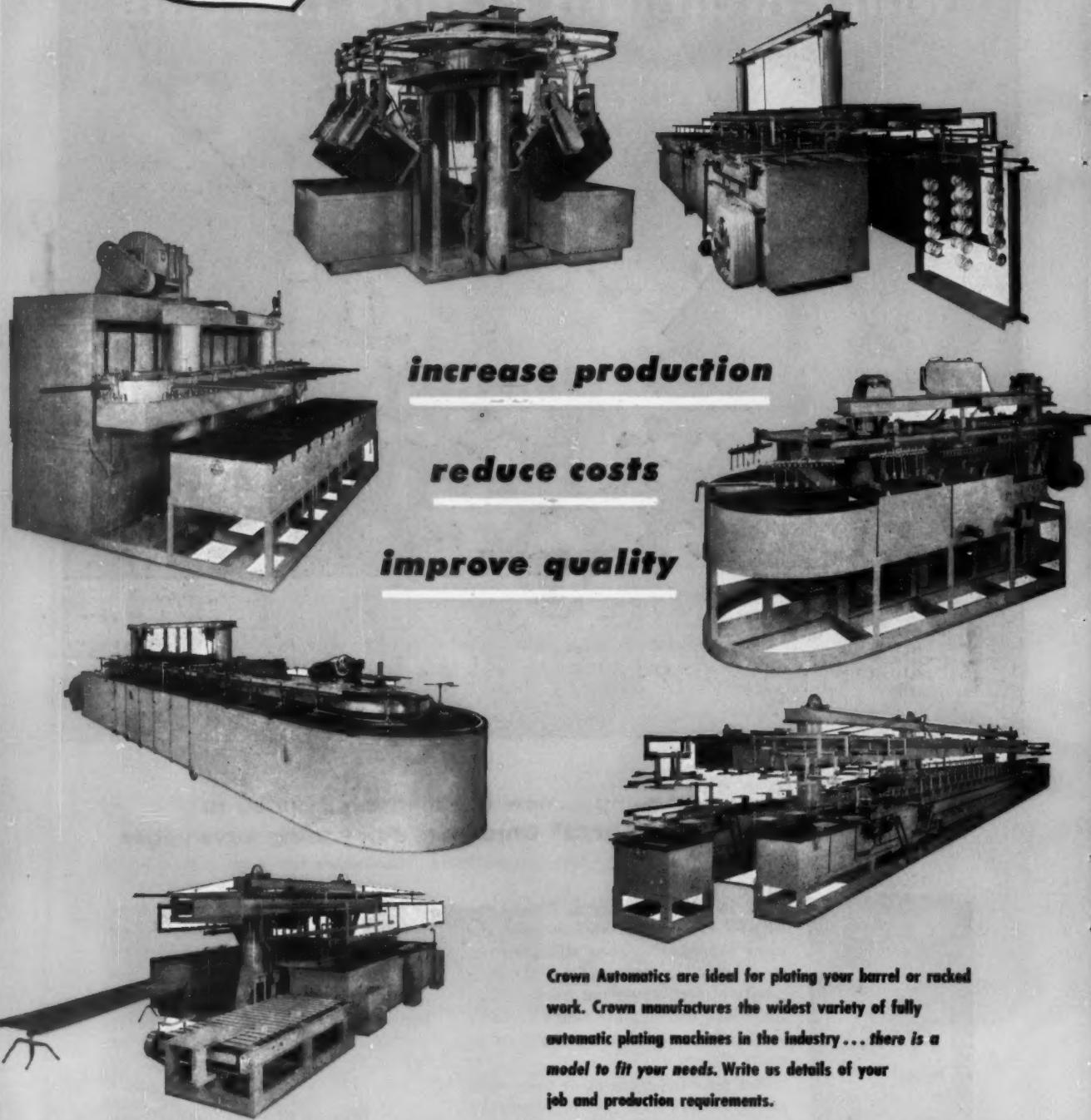
More than ever, Unichrome SRHS® compounds are your best assurance of more convenient and more profitable chromium plating operations. Send for details. Or ask the M&T Man about it.



**plating
products**

METAL & THERMIT CORPORATION
General Offices: Rahway, New Jersey

CROWN AUTOMATICS



increase production

reduce costs

improve quality

Crown Automatics are ideal for plating your barrel or racked work. Crown manufactures the widest variety of fully automatic plating machines in the industry... there is a model to fit your needs. Write us details of your job and production requirements.

CROWN RHEOSTAT AND SUPPLY COMPANY

1965 PRATT BOULEVARD • ELK GROVE VILLAGE ILLINOIS

A REVOLUTIONARY, NEW PROCESS

CUTS
PLATING AND
ANODIZING
COSTS
33% TO 50%

A typical Colorward application... 2800 keys, displacing 2½ cubic feet of tank space.



SAVE TIME! SAVE SPACE! SAVE MAN HOURS!

Save money, motion and material with Colorward's revolutionary new work holding process. Now, mass immersion of small objects is possible in remarkably small space, with actual improvement in quality... at savings up to 50% over present systems. The patented Colorward process can be licensed on a volume or monthly basis. Our engineers will adapt the Colorward process to your needs and equipment. Your inquiry is invited without obligation.

COLORWARD CORPORATION
4515 SUPERIOR AVE. • CLEVELAND 3, OHIO

COLORWARD CORPORATION • 4515 Superior Ave. Cleveland 3, Ohio

Gentlemen:

We are interested in finding out more about the Colorward process.

Please contact us.

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

STRIPEX #153

THE NEW MIRACLE

PAINT STRIPPER

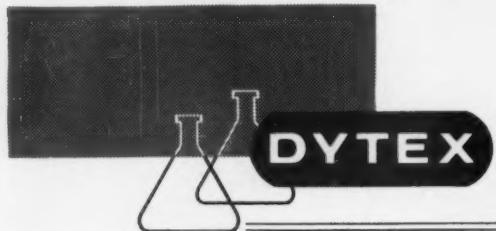
NO HEAT NECESSARY!

A mild steel tank is all that is required. Strips all types of baked enamels.

Some baked coatings are stripped clean in a matter of seconds.

Excellent for stripping.

Enamels and Lacquers • Melamines • Zinc Chromate Finishes • Plastics • Vacuum Plated Finishes • Plating Racks • Insulating Varnishes • Epoxy Finishes • Rubber Coatings • Vinyl Coatings



Chemical Co.

140 INDIA STREET

• PROVIDENCE 3, RHODE ISLAND

TELEPHONE JACKSON 1-6570

DATA SHEET AVAILABLE UPON REQUEST.

Covers constitution, applications and properties.

HOT ORGANIC COATINGS

by RAYMOND B. SEYMOUR

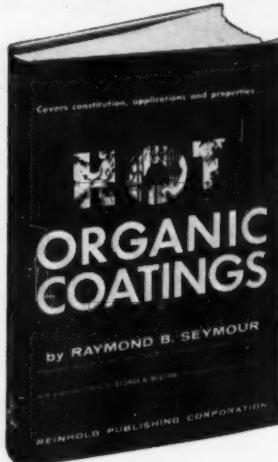
President, Alcyline Plastic and Chemical Corporation

With a special chapter by GEORGE B. McCOMB

Consultant to Suppliers of Pipe Line Coatings

1959, 244 pages, \$7.50

The constitution, applications and properties of hot organic protective coatings are concisely presented here. The book contains chapters on widely used hot organic materials such as asphalt, coal-tar pitch, petroleum waxes and cellulose derivatives. Specific information on formulations of proprietary products is included. Additional chapters deal with hot melt applications without solvent such as peel coatings, protective linings, flame spraying and the fluidized bed process. One chapter on hot applied coal tar pitch base coatings is supplied by George B. McComb, consultant to the leading suppliers of pipe line coatings. Hot spray techniques and the many advantages of this application are also covered. This book will be helpful to everyone using these coatings in any form.



CONTENTS:

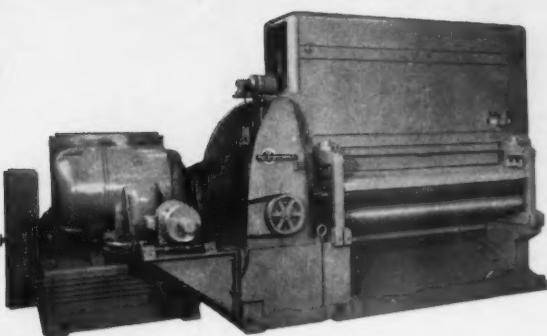
- Coating Fundamentals
- General Discussion of Hot Coatings
- Asphalt and Related Products
- Coal Tar Pitch
- Petroleum Waxes
- Synthetic Hydrocarbon Resins
- Cellulose Derivatives
- Animal, Vegetable & Insect Waxes
- Miscellaneous Products
- Applications in the
- Absence of Solvent
- Hot Applied Coal-Tar Pitch Base Coatings
- Hot Solution Applications
- Tests
- Trends and Potentials of Hot Coatings
- Index

Order Now For Immediate Delivery

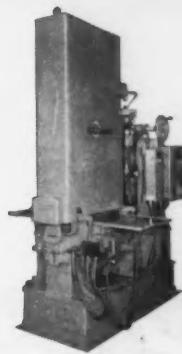
Please send remittance with all orders

METAL FINISHING

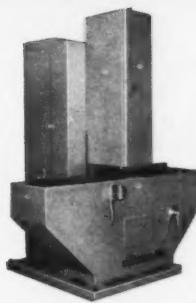
381 Broadway, Westwood, New Jersey



THIS MASSIVE SHEET POLISHING MILL is a pinch-roll type machine to be used for wider flat stock grinding and polishing with belt widths up to 74 inches. A few applications include: prepolishing of stock before forming; polishing stainless steel to standard finishes; upgrading finish of commercial rolled stock; and sizing of various types of sheet and coil stock to engineering tolerances.



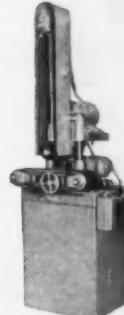
THE MODEL FSP-20 MACHINE is a high production, pinch-roll type for polishing of sheet, coil or bar stock. Printed circuits are typical applications for this model. A series of narrow parts can be run side by side on the machine for increased production requirements.



THE MODEL KC-8 MACHINE is a conveyor belt type for high production of miscellaneous shaped parts having flat surfaces to be ground, polished or deburred. Typical applications include parts for tools, hardware, appliances and automobiles.



THE MODEL KP-8 MACHINE is a pinch-roll type for high production of sheets, coil or bar stock. Square or rectangular tubing and extrusions up to 4 in. thick are other common applications. The design of the machine provides a range from heavy stock removal down to fine finishing.



THE MODEL JC-6 MACHINE is a low-cost, high-production grinder and polisher. It is available either as a bench model with conveyor as shown, or the head can be used in conjunction with rotary tables. Multiple head assemblies can be mounted along one common conveyor belt.

ACME the complete line for flat grinding and polishing

These quality abrasive belt grinding and polishing machines are ruggedly built to resist vibrations and produce high-quality finishes. Made in five basic designs, they provide belt widths from 6 to 74 inches. Practically any kind of flat grinding, polishing and deburring operation can be expertly performed on these versatile units. Let Acme polish off your finishing problems. For complete information write:

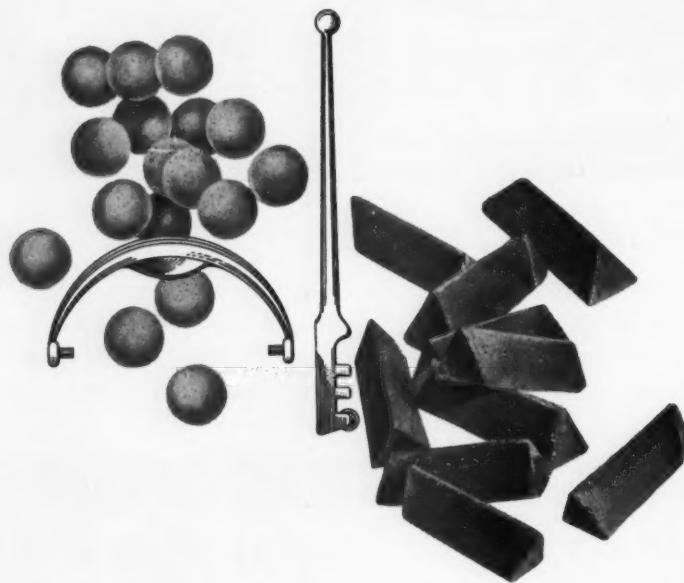
ACME MANUFACTURING COMPANY

1400 E. 9 MILE ROAD, DETROIT 20, (FERNDALE) MICHIGAN

FOR HALF A CENTURY, LEADING PRODUCERS OF AUTOMATIC POLISHING AND BUFFING MACHINES



Barrel Finishing is best finishing ...with TUMBLEX^{} bonded abrasives*



Your sure way to cut finishing costs-per-piece is to combine the best barrel finishing techniques with the best abrasives. Norton can help you make the right choices.

Among the wide variety of Norton barrel finishing abrasives, bonded TUMBLEX abrasives are made of ALUNDUM* abrasive in four shapes — "T" triangles, "S" spheres, "TP" triangular pins, "RP" round pins. Available in many sizes, they provide fine, uniform finish, short-time cycles, long, even wear and sure savings on many finishing jobs.

Send samples of parts you finish to our Sample Processing Department. We'll barrel finish, return samples and report the methods and abrasives you need to improve quality and cut costs. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES

G-380

Making better products . . . to make your products better
NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes



Now, one grade of trichlor does both

Whether you clean a rocket or degrease a gear, you can now use Nialk® metal degreasing grade trichlorethylene as your cleaning agent.

This grade of Nialk meets rigid government and industry standards for solvents used to clean rocket and missile components. It leaves little or no residue when it evaporates. At the same time, it keeps the above-average chemical stability needed for vapor degreasing.

The savings in this twofold use of one grade of trichlor can be readily seen. Now you can:

Cut your inventory and make your buying easier.

Avoid errors. No one can pick the wrong drum when you're buying just one grade of trichlor.

Make your materials handling easier.

Help end your disposal problems. Usually you can use the Nialk trichlor from your flushing operation in your vapor degreasing operation without distilling, or the solvent can be recovered and used again and again.

STABILITY WITH psp

You get psp too, when you ask for Nialk trichlorethylene. psp is "permanent

"staying power," the ability of the stabilizer to keep from wearing out.

You can get more information on this metal degreasing grade of Nialk trichlor. Just write for specifications and data.

HOOKER CHEMICAL CORPORATION

1312 UNION STREET
NIAGARA FALLS, N. Y.



Sales Offices: Chicago, Detroit, Los Angeles, New York, Niagara Falls, Philadelphia, Tacoma, Worcester, Mass.

In Canada: Hooker Chemicals Limited, North Vancouver, B. C.

Yes, there's an answer to corrosion, after all

the
udylite

Bi/NICKEL[®]

PROCESS

The combination nickel that's making plating history

only from Bi/NICKEL do you get all these benefits

1 SUPERB CORROSION RESISTANCE

Under actual exposure to highly corrosive atmospheres as well as accelerated CASS and Corrodokote tests Bi/NICKEL has proven its superiority over other bright nickel coatings.

2 THE MOST BEAUTIFUL FINISH

Color and brilliance obtained with Bi/NICKEL incorporating Udylite Bright Nickel, such as the Incomparable 66 and other Udylite nickel processes, cannot be matched.

3 ADHESION PROBLEMS LICKED

Bi/NICKEL offers a solution to adhesion problems previously considered inherent in combination nickel processes. Chrome finishes "take" to Bi/NICKEL with remarkable facility.

4 FULL RANGE OF COMBINATIONS

There is a version of Udylite's Bi/NICKEL which is adaptable to your product and problem whatever the demands of basis metal or the limitations of your already installed equipment.

you get Bi/NICKEL only from

5 INCREASED PRODUCT POTENTIAL

Here in Bi/NICKEL is a process that will immeasurably enhance the real value of the products to which it's applied. Longer life of usefulness and beauty can be expected from a Bi/NICKEL-Chromium finish. It gives you a real talking point when it comes to sales.

6 ANSWERS CUSTOMER COMPLAINTS

Bi/NICKEL is a step in the right direction toward solution of corrosion problems that have harassed automotive manufacturers and all others where corrosion has been a factor in a product's "life expectancy".

Discover TODAY how the Udylite BI/NICKEL process is just what you've been looking for to meet and beat your corrosion problem.



DETROIT 11, MICHIGAN
WORLD'S LARGEST PLATING SUPPLIER



Metal Finishing

POLISHING AND BUFFING • BARREL FINISHING • CLEANING
PLATING • ANODIZING • RUST PROOFING • LACQUERING & ENAMELING

DECEMBER, 1959

Volume 57 No. 12

FEATURES

Editorial — You Figure It	53
Metal Finishing in Europe Today	54
By Daniel A. Marino	
Testing Plating Durability	59
By George L. Sukes	
Do You Appreciate the Dilemma of Depreciation?	66
By Irving Elbaum	
Infra Red Baking of Organic Finishes	69
By G. J. Marotta	
Control of Watts Nickel Baths	74
By J. B. Mohler	
Science for Electroplaters — Part LIII	75
By L. Serota	

DEPARTMENTS

Shop Problems	79	Manufacturers' Literature	100
Professional Directory	80	Business Items	102
Patents	81	Associations and Societies	111
Abstracts	84	Obituaries	117
Recent Developments	90	News from California	118
Annual Index			125

Published Monthly By

Metals and Plastics Publications, Inc.

Established in 1903 as Metal Industry by Palmer H. Langdon 1868-1935.
381 Broadway, Westwood, N. J.
NOrth 4-1530

Joan Trumbour Wiarda, President and Advertising Director; Palmer H. Langdon, Publisher; John E. Trumbour, Business Manager; Elizabeth Meyers, Circulation Manager; Nathaniel Hall, Technical Editor; Daniel A. Marino, Ass't. Tech. Editor; Inez Oquendo, Equipment & News Editor; James J. O'Brien, Market Research Manager; Dave Kingwill, Advertising Representative; Chris Dunkle & Associates, Pacific Coast Representative; John Ashcraft, European Representative.

Chicago 1
35 East Wacker Drive
Financial 6-1865

BRANCH OFFICES

Los Angeles 5, Calif.
740 So. Western Ave.
DUnkirk 7-6149

SUBSCRIPTION INFORMATION

United States and Canada \$5.00 per year, other countries \$10.00. Single copies 65c in United States and Canada, other countries 85c. GUIDEBOOK-DIRECTORY 28th edition 1960 current, 5 1/4 x 7 1/2, subscriber's edition \$2.50 per copy. Please remit by check or money order; cash should be registered. Request for change of address should reach us on or before the 15th of the month preceding the issue with which it is to go in effect. In sending us your change of address, please be sure to send your old address as well as the new one. It is difficult and often impossible to supply back numbers. Copyright 1959 by Metals and Plastics Publications, Inc. All rights reserved. Contributed articles, letters or pertinent subjects are invited. Their publication, however, does not necessarily imply editorial endorsement. Re-entered as second class matter June 13, 1940 at the post office at New York, N. Y. under the Act of March 3, 1879.



Audit Bureau
of Circulations

Member



Society of Business
Magazine Editors



Saint Nick enjoys the longest list of satisfied customers in history. The dependable old gent, always in step with progress, returns year after year to the same eager clientele.

Technic, too, enjoys the confidence of its customers. Our list of new friends grows annually, and happily we have retained all of our old ones, because they know they can rely on Technic quality and service.

And so, we, the producers of the world's best soluble precious metals for electroplating, take this opportunity to thank our friends, new and old, for your continuing faith in us, and to wish you a most prosperous New Year.

Technic



P.O.Box 965
Providence, R. I.
Stuart 1-6100

Chicago Office
7001 North Clark Street



H-VW-M
ANNOUNCES
A GREATLY IMPROVED
BRIGHT CYANIDE COPPER

COPPER-LUME

Improvements in nickel and chromium plating processes and methods have made plated coatings more durable and desirable than ever before. It was inevitable that a copper process be developed to keep pace. New Copper-Lume is that process.

Hanson-Van Winkle-Munning Company, Matawan, New Jersey.
Offices in Principal Cities.
Alert Supply Company is H-VW-M in the West.
Los Angeles • San Francisco



H-VW-M

*Progress in metalfinishing through
advanced processes • equipment*

Metal Finishing

POLISHING AND BUFFING - BARREL FINISHING - CLEANING
PLATING - ANODIZING - RUSTPROOFING - LACQUERING & ENAMELING

ESTABLISHED 1903

VOLUME 57

NUMBER 12

DECEMBER, 1959

YOU FIGURE IT

Once upon a time, when this editor was only a young lad thirsting for knowledge of any and all kinds concerning metal finishing, an employer explained the technique of pricing, thus:

"You take the direct labor cost of each operation and multiply by three, not forgetting to include packing and shipping. Then you guess the amount of anode metal consumed (it had to be a guess because Faraday's law couldn't be enforced without an ammeter, a refinement then employed only by impractical scientists). To this you add the cost of the stringing wire (in those days racks were only for the rich), in both cases allowing twenty-five per cent for waste. The sum of these figures is the price quoted the prospective customer, while watching closely for a slight reddening about his ears, the appearance of which calls for an immediate twenty per cent quantity discount.

"If he is already having the work plated, and produces your competitor's invoice to confirm his original poor impression of your competence, the calculations should be discarded and the second pricing approach initiated. This is based on the assumption that the competitor knew how to figure his price and, since he was still in business, must have made a profit on the job. Therefore, you quote ten per cent less, because you have a smaller family to support. Of course, if he is no longer in business, it is obvious the price had been too low, and you quote ten per cent more.

"Both methods of figuring price have their pitfalls. In the first technique, you must remember, when checking the time it takes to polish a few sample pieces, that you will not get an hour's work from a polisher each hour, because time will be lost in changing the wheels, opening a new can of buffing lime, and for personal reasons. In the second technique, there is always the possibility that the competitor's invoice was for a trial lot, on which he lost money and, in consequence, refused to finish any more of these parts, this also explaining why the customer is looking for a new source.

"The worst thing that can happen to you is for the customer to immediately accept your first quotation. For, then, you will have to go through life without ever learning how much you could have gotten away with, and for a long time will reproach yourself for not quoting at least ten per cent more than you did."

It's still being done the same way!



Metal Finishing

Wishes You A Very Merry Christmas and A
Happy and Prosperous New Year

Metal Finishing In Europe Today

By Daniel A. Marino, Assistant Technical Editor

Introduction

AS evidenced by the rapid pace of science and technology throughout the world today, and of the metal finishing field in particular by the enormous success of the recent Fifth International Conference in Detroit, metal finishers of all major countries are increasing their international awareness. The effects of this trend can result only in better understanding among the world wide groups of finishers both as colleagues with a common technological goal and, more important, as fellow men with a desire to enhance the material and spiritual lot of their foreign counterparts.

Though the profit motive remains a deep rooted factor for all items of commercial significance, and some local trade secrecy will always persist in all countries, the increased international feeling of cooperation appears to have ameliorated the situation considerably in recent years. We in the United States were among the first and most active to disclose commercial plating bath formulations. While supply houses in Europe were still the only convenient sources for plating solution analysis and control, even small job platers in this country had some means of checking their baths and making necessary corrections. In this article it will be pointed out that European supply houses are still the most important sources for obtaining ready-mixed chemicals for plating baths as well as still being prominent sources for solution analysis and control. Because

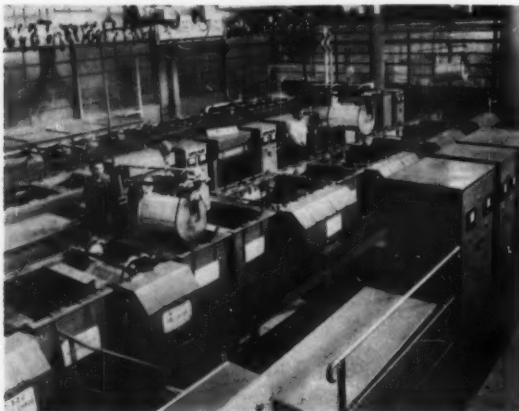


Fig. 1. Semi automatic barrel installation used to electroplate cadmium deposits.

of the special conditions surrounding the metal finishing field in Europe, it will also be seen that such a practice appears to be justified.

In Europe numerous factories, laboratories, supply houses, and universities dealing with metal finishing

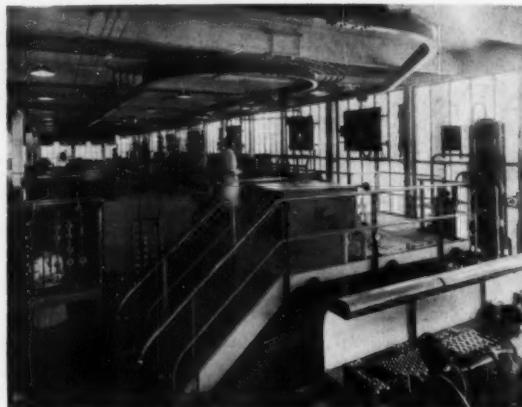


Fig. 2. A nickel plus chromium semi automatic plating installation.

were visited in France, Italy, and West Germany. Since the visits were brief, only the salient features of each location could be discussed. Nevertheless, it is felt by this writer that many of the items will be of interest to the American metal finisher, and even at the risk of incompleteness, they will be mentioned.

Growth of the European Metal Finishing Industry

Metal finishing activity, along with many other phases of the industrial scene, has witnessed a phenomenal growth in Europe following World War II. It appears at this time that England and West Germany are about equal in size and activity in the finishing field, though West Germany continues to grow more rapidly. French and Italian activity are about equal, even though capital investment for equipment and plant is higher in the former country. Because of the existence of more old equipment and less favorable labor conditions in France it appears that, at the present time, this country is somewhat less efficient than Italy. While visiting France the impression was gained that

strong efforts are being made to boost the entire industrial economy of the nation, and it would not surprise us to learn that a significant rise in metal finishing activity will follow.

Switzerland remains a small-component-type plating nation and, though the number of items (mainly for watches and precision electronic components) is large, because of their miniature sizes plating activity as we are familiar with it is very low. Since we did not visit any finishing plants in Switzerland it will not be mentioned further.

In travels through the various European countries we spoke to platers, organic finishers, suppliers, consultants, professors, and economists. The general feeling among those engaged in metal finishing activities is one of optimism. In France the feeling appears to be somewhat more cautious, with some predicting that, not until a significantly large rise in other phases of the industrial economy occurs, will finishing activity reach similar high levels. With an austerity program in force generally, it behooves our French counterpart to anticipate hopefully a future having higher profits



Fig. 3. Two automatic units plating faucets and other plumbing articles. The first is for copper plating. After polishing, the articles are nickel and chromium plated.

and greater prosperity if and when the growth materializes.

In Italy, where we first visited metal finishing plants, we encountered plating facilities very similar to those in the United States. Following Italy, our itinerary took us through Austria, where we briefly visited metal finishing colleagues, then to West Germany. Here we saw with some surprise automatic plating units of all descriptions. Ambitious programs of metal finishing research and development work were being conducted in numerous laboratories. After West Germany we visited France, which appears to have not only much less finishing activity in progress, but also to have an ominously greater amount of labor difficulties. France, which could profit most with more automation — and is ideally situated geographically to justify its incorporation — has relatively few full automatics with which to operate.

Though we were not fortunate enough to visit plants in England in order to see their plating and painting operations first hand, we did enjoy the opportunity to



Fig. 4. Full automatic plater used to coat nickel and chromium on zinc die castings.

talk to some of that country's well known authorities in the field, thereby gaining what we hope is at least a partial understanding of the English metal finishing scene. In this article the European metal finishing industry in general will be described with particular emphasis on France, Italy, and West Germany.

France

Electroplating activity in France, though it had fallen somewhat behind that of its neighbor Italy, appears to be witnessing a resurgence. One reason for this is the new approach French businessmen are using to increase their foreign trade. Another reason, which is more political in nature, is the increased confidence a large portion of the industrial market has shown, both at home and abroad, in the future financial picture. This confidence stems from the feeling that a more financially and politically stable government now in office will more satisfactorily meet its assigned obligations.

The number of electroplating full automatics in France has increased steadily until now there are over 82 such installations in the country. The nation prides itself on its vast output (in the millions) of bicycles, yet only a relatively small proportion of bicycle components are actually electroplated in France. Two reasons account for this. One is that reasonably good work at attractive prices for plating these parts is readily available from the Netherlands. The second reason revolves around the cost of new installations in France, particularly full automatic machines. Just so much capital has been made available for all industrial activity; partly because of limited foresight and partly because of the strong influence other segments of industry have exerted, the electroplating portion has suffered a stunted growth.

There are indications, however, that this condition is in process of being rectified. Even when compared to other parts of Europe, where operations are similarly conducted manually in the electroplating and allied fields, output is low. The reasons for this appear to be more in the nature of labor relations rather than in good engineering design and operation.

Even though France has more than its share of antiquated plating and painting procedures as well as obsolete plating equipment, a sizable percentage of its

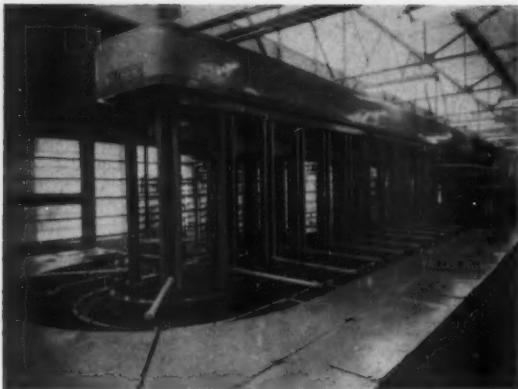


Fig. 5. A full automatic used for cadmium plating.

finishing facilities and operations (particularly in its newer installations) can be compared favorably with the best of those in America.

PRE MIXED PLATING CHEMICALS:

As in other parts of Europe, proprietary plating solutions are the rule rather than the exception. This condition exists throughout Europe because of the relatively low cost of unskilled labor compared to that of technicians and chemists. Since material costs are relatively high and wastage therefore very expensive, European platers are willing to pay a little more money for "guaranteed" results. For this reason, and under present conditions in Europe, one can justify the European practice of buying ready-mixed plating salts to which the plater need add only water, dissolve, and proceed to electroplate. Under prevailing American conditions, the economics dictate for the most part self-mixing and chemical control.

Even with so many ready-mixed solutions and cleaners available in France, it interested us to see that some plants still go to the trouble of mixing their own chemicals for special purposes. One captive plating shop, which still believes in aging (or mellowing) their plating baths after preparation, had an interesting bath in operation. The chemist was quite satisfied with its results and readily divulged its composition and permitted publication of same. The solution was a combination electrocleaner and copper strike. It had the following composition:

Sodium carbonate	8 oz./gal.
Sodium hydroxide	6 "
Sodium cyanide	2 "
Sodium silicate	1 "
Trisodium phosphate	3 "
Copper cyanide	1 "

The operating temperature was 170-190°F.; and the voltage was 6. Mild steel and two copper bars were used as anodes.

COLD PHOSPHATING:

Although some other European metal finishers also expressed interest in room temperature cleaning, plating, and phosphating operations, the French finishers appeared most anxious of all to investigate these practices. As best as we could determine, the reasons are

the high costs of fuels to heat the solutions. It would also seem, judging from the appearance of the finished work resulting from low operating temperature surface treatments, that this policy has had somewhat adverse effects.

Although previously informed that a very large percentage of cold rolled steel used in Europe (including much of that used for the body of the Volkswagen) is produced in the U.S.A., almost everywhere we examined such steel, it did not possess the characteristic mill finishes and color of the more commonly available American product. In most instances, the steel had a smoother surface, even in the heavier gages. In France, where we asked an engineer who was functional for steel whether this was premium material, we were told that it was standard cold rolled stock and competitive with others available in that area.

Re-evaluations of plating characteristics and plating bath operations are being accelerated in France and, particularly, in the fast-growing automotive industry, numerous changes designed to upgrade the product are taking effect.

Italy

When traveling through Europe by auto, the American tourist cannot help becoming aware of the ubiquitous motor scooters. As France boasts of its fine bicycles and Germany of its workhorse Volkswagens, the Italian contributions to the brisk (sometimes nerve-wracking) European road scene are the Vespa and Lambretta motor scooters. Both are of approximately

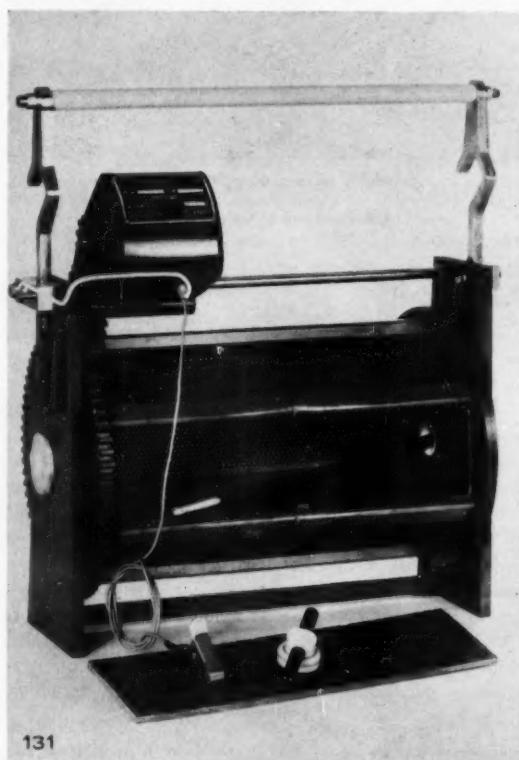


Fig. 6. Portable barrel having a small D.C. motor attached, used for plating in existing still plating tanks.

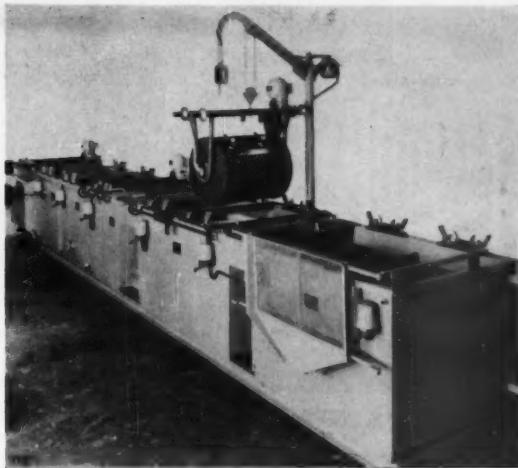


Fig. 7. In Barrel plating line showing lifting mechanism with a raised plating barrel.

equal importance, though the former has been on the market somewhat longer.

FINISHING OF MOTOR SCOOTER:

Lambrettas are made by the Innocenti Co. of Milan. Although the firm's primary products are heavy machinery for rolling mills, heavy presses, and other metal forming equipment, a sizable portion of their facilities are devoted to providing the Lambretta motor scooter.

In our tour of Innocenti we were shown the entire plant layout of the Lambretta production line as well as some of the heavy machinery-building facilities. This discussion shall be limited to description of the finishing activities and, particularly, to the enameling line for the motor scooters.

In one section relatively bright, smooth, cold-rolled sheet and strip steel are formed by conventional blanking and drawing methods into numerous components for the motor scooter. In another section items are cast, heat treated, forged, and machined for motor parts and special purposes. The bulk of parts which are given subsequent organic finishes are the cold-rolled steel items. After these are formed and degreased, they are placed on hooks traveling on an elaborate overhead conveyor. The parts then pass through two electrostatic spraying areas, one for an organic primer and the other for a finish enamel coat. Each system consists of a battery of rotating discs at different levels to assure complete coverage of the parts.

At the end of the enameling line an operator with a spray gun touches up occasional blemishes. At the time we toured this area it appeared that, by American standards, the coating was not flowing properly. Yet, on all the completed Lambrettas we had previously seen, the enamel finishes were of very high quality, perhaps superior to the American standard. The answer to this mystery, as well as to why the host engineer appeared not particularly concerned when he witnessed the poor flowing, later became obvious when we were shown a final pre-assembly operation. In a

room of perhaps 2000 square feet, about twenty-five workers were carefully wet hand-sanding all of the enameled parts. When the parts left this room, their finishes approached excellence. From this operation until final assembly, utmost care in handling was exercised.

We were somewhat surprised to see that Lambretta was not using a phosphate or other conversion coating treatment prior to organic coating and, therefore, their engineer was queried as to whether they had considered giving the parts such a treatment. It appears that, although product engineering would prefer such a treatment, upper management has not been clearly shown its economic advantages. In view of the excellent (but expensive) primer coat being put on the Lambretta it appears that it might take a good deal of testing to accomplish such a feat. It becomes particularly difficult to obtain conclusive evidence when one must consider the myriad types of atmospheres and other conditions the scooter is exposed to throughout the world.

A large nickel and chromium installation, which was no longer being used, was located in the surface treatment area. It had been used previously on trim and other decorative items for the motor scooter. These are now made of aluminum.

ELECTROPLATING JOB SHOPS:

In another part of Italy we visited a plating job shop which, we were told, was a fairly typical one. It appeared in most respects to be quite similar to an average American job shop, though much of the equipment (rectifiers, filters, etc.) comprised European de-



Fig. 8. A unique type of plating bath filter with cover removed to show paper pad filters.

sign which Americans were unaccustomed to seeing. Polishing and plating operations were being conducted on automotive parts.

The Alfa-Romeo, which is an expensive sports car and made in relatively small quantities (as compared to Fiats and Bianchis), has rigid plating standards on many of its parts which are to be exposed to outdoor environments. Smoothness and brightness are observed critically, and re-works are common. After the parts are buffed, copper plated, and again buffed, they are plated with a leveling nickel. This particular shop was quite excited about both the leveling and brightening properties of the bath. The addition agents used were of German manufacture, and we later heard similar favorable comments in two other plating shops in Europe where these same addition agents were being used. The items electroplated for Alfa-Romeo were separated into two categories. Those made for export were given a thicker nickel deposit. All parts were carefully wrapped with soft creped paper tape, after plating and 100% final inspection, and packed for shipping.

In both this plating shop and another in Italy we saw an interesting type of plating bath filter in operation. The filter consisted of a series of rubber-molded, square shapes with filter paper sandwiched between them. These filters were being used continuously to clean bright nickel and copper baths. The plating foreman informed us that they have been running for eight years and have not required any extensive maintenance. However, at the time we were present it appeared that the continuous leaking of plating solution which was occurring (into a drain which then carried the solution by gravity back to the plating tank) would be annoying if not intolerable for most American plating shops.

ELECTROPLATING RECTIFIERS:

A large percentage of the rectifiers we observed in Europe, both in the manufacturing stages as well as in plating operations, were mainly of the liquid-cooled variety. This was particularly the case in Italy. We were informed that water-cooled rectifiers are especially popular in Italy because so many of these power units are placed in poorly ventilated areas, often amongst highly corrosive fumes. The units which we

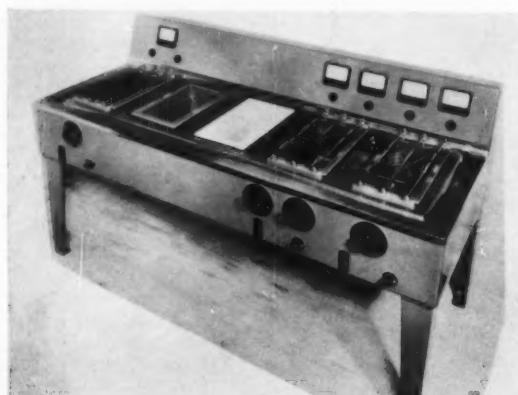


Fig. 9. A complete plating assembly having corrosion resistant heatable tanks and controllable D.C. power source.

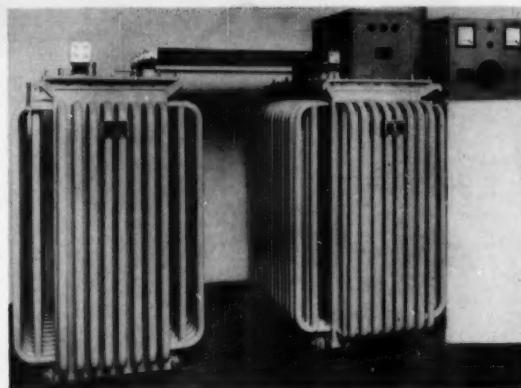


Fig. 10. Oil-cooled 5000 amp., 8 v. rectifier showing circulating coils and controls.

had the opportunity to open and examine in Italy appeared to be well constructed with very conservative electrical ratings though, perhaps in some cases, too little or no insulating varnishes and other similar functioning materials were used. Selenium diodes were used exclusively in all electroplating rectifiers we saw in Italy.

RESEARCH AND DEVELOPMENT:

At the Milan Technical University we had the privilege of meeting Professor Eugenio Bertorelle. His attitude of profound interest toward the advancement of metal finishing science and technology impressed us greatly. For a number of years, as director of the Italian technical journal "Galvanotecnica," he has almost alone pioneered attempts to found an Italian technical society for those engaged in electroplating and its allied fields. Unlike similar attempts being made in Germany, only very limited success to date has been witnessed in Italy.

In the field of academic studies however, Professor Bertorelle was enthusiastic to report that a new Milan Technical University is being constructed which will have larger metal finishing research and development facilities. Later, when we visited the partly built structure, he pointed out certain areas which would become the electroplating laboratories and other areas which were scheduled to become classrooms.

In the existing laboratories of the older university Professor Bertorelle pointed out numerous electroplating experiments which were in process. Some of these were investigations of the theories of leveling and brightening of nickel deposits. Others consisted of electroforming materials having special magnetic properties. Two other studies which were under investigation were control tests with a three cornered plating cell, and leveling properties of copper sulfate baths having complexing agents.

Most other research and development work being done in the metal finishing field in Italy is conducted in chemical supply houses.

Acknowledgments

Figures 1-5 are through the courtesy of Waldberg S.A., Puteaux, France and figures 6-10 through the courtesy of Barattini & C., Milan, Italy.

Testing Plating Durability

The Copper-Accelerated Acetic Acid Test

By George L. Sukes, Senior Research Metallurgist, Cadillac Motor Car Div., General Motors Corp.

THE need for a satisfactory accelerated test for evaluating the corrosion characteristics of plated parts has long been recognized by those responsible for plating quality. It is now believed that this need has been met by the copper accelerated acetic acid salt spray — "Cass Test." Before discussing this test in detail, it would be profitable to consider some of the steps that led up to it, including some basic requirements.

To be acceptable as a test for the quality of plating by producer and purchaser, any proposed procedure must satisfy the following requirements:

1. Indicate relative durability and unsatisfactory parts within a short test cycle.
2. Produce a degree of failure in proportion to the duration of the test.
3. Reproduce the same characteristic corrosion failures as observed in service.
4. Reflect, in varying failures, the effect of known variables on plating quality.
5. Be easily controlled.
6. Be reproducible.

It is recognized that an acceptable test will not always reproduce in a standard time the degree of corrosion met with in all areas of service.

In respect to plated parts on automobiles, it is recognized that durability is influenced by the variations in weather from year to year, by the difference between rural and urban atmospheres, by the quantity and types of de-icers used on streets and highways during winter months, and by widely divergent extremes in owner care.

Prior to 1954 there was no satisfactory method for evaluating the durability quality of "chrome plate," although the ASTM tentative method B117-41T and its predecessors in industrial use were effective methods for evaluating zinc plating on steel, and for a number of miscellaneous corrosion problems. Unfor-

tunately, industry had been led to accept this method, lacking a better one, for testing "chrome plate." While some engineers recognized the lack of validity and their specifications recognized same, too many did not, and the door was wide open for lowered plating standards and poor quality without any means of determining such before service failure occurred. This process began in the late Nineteen-Twenties, and was accompanied by wide divergence in the degree of reverence with which the test was regarded. Unfortunately, the establishment of B117-41T did not solve any of the basic problems, and the disagreement was so serious that a concerted attack on the problem was made by a special committee composed of representatives from all General Motors Divisions, and in other areas of industry. These activities resulted in a demonstration of the fact that replacing the 20% salt concentration by 5%, and tightening the collection rate requirements and other operating details, would permit reasonably reproducible results. These conclusions were presented to ASTM through Sub III of Committee B-3 by W. D. McMaster² as the representative of the General Motors Group, and later reported in the ASTM Bulletin of January 1955. The ASTM method of 1941 was accordingly revised and adopted as B117-54T. This revision was based on the higher humidity produced in the 5% salt spray, freedom from nozzle clogging, greater ease of control, and reduced costs in labor and material.

In 1945, C. F. Nixon,¹ published his research on an acetic acid modification of the 20% salt spray used at 120°F. as a means of indicating blistering tendencies of plated zinc base die castings. This work was reviewed and expanded by an ASTM working group under the leadership of W. D. McMaster, with the assistance of General Motors Divisional Laboratories, and finally presented to ASTM as a modification of the method B117-54T. It was accepted by ASTM and

designated B287-54T. The modification consists in the addition of sufficient acetic acid to the salt solution to produce a pH of 3.2 ± 0.1 . Preliminary studies indicated the method to be ideally suited to the testing of "chrome plate" and adaptable to most other metallic and non-metallic corrosion testing.

Late in 1955, the author adopted the acetic acid salt spray as a means of studying plating quality and the effect of production process variations. As a result of these investigations, factors such as plating thickness, preparation of the basis metal surface, buffing of intermediate layers of deposit and alternation of metallic layers of plating were viewed in their perspective effect on plating durability. It was during the course of this research that the effect on corrosion of the final chromium deposit of a copper-nickel-chromium plating system was substantiated. These investigations resulted in considerable improvement in quality. In addition to these research investigations, a quality control program based on acetic acid salt spray testing and plating thickness measurements was established on the 1956 model and maintained for each of the plated and anodized parts used on the exterior of the Cadillac automobile. These data are now being used to compare test results with field failures over a long period of time.

The acetic acid modification of the salt spray test provided industry with the first reliable tool that would evaluate quality and predict durability of plated parts. As the model year progressed at Cadillac it was obvious that the acetic acid salt spray, requiring at least 192 hours to qualify an item, was too slow to serve either as a control for daily production or for an acceptance test by the customer. Each routine test was practically a research investigation in itself, because the individual test samples had to be evaluated and rated every twenty-four hours for eight consecutive days. Frequency of testing had to be reduced because test cabinets became overloaded, and immediate corrective action was hampered because of the length of time required to complete the test. These factors spurred the investigation and development of the accelerated salt spray — "Cass Test."

The Mechanics of Corrosion

It is desirable at this point to review the mechanics and chemistry of the corrosion of plated parts in service and in various salt spray tests. For brevity, only copper, nickel, zinc, cadmium, and chromium will be considered, plated individually or in various combinations on iron (steel) or zinc base die castings.

The term *corrosion* is used to denote the destruction or dissolving of a metal by chemical or electrochemical action. A metallic coating may protect the basis metal in one of two ways. First, a metallic coating in intimate contact with a different basis metal exerts a sacrificial protective influence and inhibits the corrosion of the basis metal when the coating and base are wet simultaneously by an electrolyte, a notable example being zinc plating on steel or iron. Second, a metallic coating may protect a basis metal in a mechanical way by excluding air, moisture, and corrosive elements, e.g. copper, lead, nickel, and tin

protect iron and steel in this manner.

It is unfortunate that plated metallic deposits are subject to shortcomings. First, some metallic coatings are susceptible to the same corrosive elements as the basis metal to which they have been applied for protection. Second, commercially deposited metallic coatings exhibit discontinuities and pores; corrosive elements work on these deficiencies and permeate to the basis metal, thus partially or wholly destroying the intended protective value of the metallic coating.

In developing a test solution for use with the salt spray it may be assumed that the degree of corrosiveness achieved in this test can be controlled within certain limits by making chemical additions to the basic 5% sodium chloride solution used in the Neutral Salt Spray Test and by changing operating temperatures.

In the case of the 5% Neutral Salt Spray test both chemical and electrochemical reactions will take place depending upon the type of metal being subjected to test. Experimentation has shown that the salt of the alkali metal, sodium, when added to water increases the rate of corrosion of iron, steel, and zinc. Nickel and chromium are normally passive to this solution and copper and cadmium are only mildly affected. For these reasons, steel plated with copper, nickel, and chromium would be little affected by this test, except in those cases where extremely porous plating permitted rapid penetration to the basic metal.

The addition of acetic acid to the basic 5% sodium chloride solution increases the rate of corrosion of most metals. In general, salts of metals formed by the reaction of acids are usually more soluble than those caused by neutral or basic reactions. In addition, most metals are more soluble in acid solutions than in neutral or basic solutions, which tends to increase corrosion and provide for more contamination of the test solution by the salts of the corroded metals. The result of this contamination increases corrosion due to electrolysis.

This gives a hint as to a method for further accelerating the corrosive action of a basic 5% sodium chloride solution. A review of the electromotive series⁴ shows that all of the metals involved in common plating operations (i.e. nickel, iron, zinc, cadmium, and chromium) have positive E.M.F. potentials, with the exception of copper which has a negative E.M.F. potential. It is known in galvanic corrosion that the greater the difference in E.M.F. potential that exists between metals the greater the rate of corrosion that take place due to electrolysis, all corrosion taking place on the metal having the most positive E.M.F. potential. This wide variation of voltage between copper and the other metals involved in plating of steel and zinc base die castings suggests that copper salts should be a good accelerator to the acetic acid salt solution. Salts of silver, mercury, lead, palladium, platinum, and gold could be expected to increase the corrosion rate even more than copper, since all of these salts have a more negative E.M.F. potential than copper. Copper salts have been selected as the accelerator in preference to salts of any of these metals due to cost, availability, and solubility.

In addition to the above, it was known that solutions containing ferric salts accelerate the corrosion of copper and iron.⁵ It is further known that chemical reactions are normally accelerated by higher temperatures, and tests conducted by G. L. Cox⁶ reported that the corrosion rate of zinc increases with increasing water temperatures.

A large number of preliminary tests were conducted by the Materials Laboratory, with the objective of establishing a test which would duplicate in a 24-hour test period corrosion encountered in the field during one year of severe service and, therefore, would be comparable with the acetic acid test at 95°F., run for 192 hours. In the preliminary screening it soon became evident that, under the pH conditions of the test, ferric chloride could not be used as one of the accelerators because iron was precipitated from the solution, deposited on parts, clogged filters and nozzles, and made the test difficult to control. At the same time, working with copper-nickel-chromium plated steel it was noted that raising the pH above 3.3 reduced the severity of the test, while lowering it below 3.1 produced excessive etching of the metallic surface rather than the red dust failure observed on this type of plating in atmospheric service conditions.

The Cass Test

As a result of this work the following special test conditions were set up:

Saturator Tower Temperature 130 to 135°F.
 Salt Fog Chamber Temp. 120°F. plus 2 minus 1°F.
 Mist Collection Rate 1 to 2 ml./hr./80 sq.cm.
 pH of Collected Mist 3.2±0.1
 Salt Solution 5 gal. distilled water
 5% by weight sodium chloride
 5 grams cupric chloride
 pH 3.2 adjusted with glacial acetic acid containing
 less than 0.0001% iron

It has been demonstrated that a laboratory will

normally check itself rather well when employing this test but, since test differences may occur amongst different laboratories, the following warrant consideration as part of the procedure.

1. In general, control the conditions and conduct the exposure as detailed in ASTM B287, substituting the above special operating conditions for the Cass Test.

2. Modify a commercial box, if necessary, so that the exhaust will be from the bottom of the cabinet at the opposite end from the spray nozzle (plastic pipe may be used within the test chamber).

3. Control the exhaust so that pressure within the box shall not vary more than ± 0.7 inch from room pressure.

4. Clean the filter on the spray nozzle intake at least weekly.

5. Hold air pressure at approximately 15 lbs./sq.in. and adjust baffle to yield reasonably uniform distribution of mist through the box, i.e., within the limits 1.0 and 2.0 ml. per hour per 80 sq.cm.

6. Hold to the specified concentration of copper, although it appears that any concentration between 0.7 and 1.3 grams per gallon is satisfactory.

7. The grade of salt used is important. Use only those grades of sodium chloride which, in five per cent solution, shall have a pH of 6.0 to 7.0, and the amount of glacial acetic acid required to adjust to pH of 3.0 to 3.2 shall not exceed 10 milliliters per gallon of sodium chloride solution.

8. There appears to be a slight loss of acid in the process of atomization. The pH of the salt solution should be approximately 3.0 as made up to allow for this. If the pH of the collected mist then exceeds 3.3, the box is operating abnormally and action should be taken to determine the cause before conducting additional tests.

9. The nozzles normally supplied with a box are not sufficiently standard in characteristics, and may

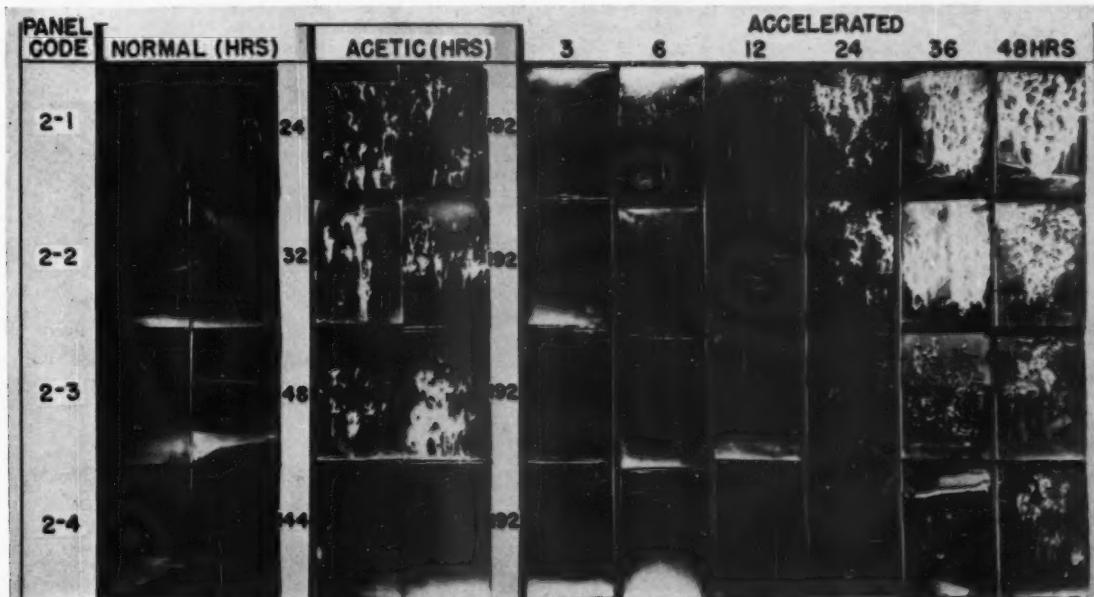


Fig. 1. Comparison corrosion of Cu-Ni-Cr plated zinc die castings under various tests.

PANEL CODE	NORMAL(HRS)	ACETIC(HRS)	ACCELERATED					
			3	6	12	24	36	48 (HRS)
3-1	32	192						
3-2	48	192						
3-3	44	192						
3-4	216	192						

Fig. 2. Comparison corrosion of Cu-Ni-Cr plated aluminum under various salt spray tests.

contribute to disagreement, particularly if 15 pounds happens to be the critical pressure for the nozzle.

10. The saturator tower is a source of error. If the air supply contains grease, test results will not be concordant. If the tower is not kept filled to a constant level automatically, test results will be off, and the heater may burn out overnight.

11. After filling, and after each inspection, the box must be closed and allowed to come to temperature before starting the salt spray. Heating up time is not counted as part of the exposure. The temperature specified for the salt fog chamber must be maintained or results will be inconsistent.

This test procedure was found to produce accelerated corrosion of anodized aluminum and of copper-nickel-chromium plated steel in 24 to 48 hours, that was approximately a duplicate of that produced by the acetic acid salt spray ASTM B-287, in 192 hours

and, likewise, proved to have the same characteristics as that found on automobiles in service. The studies were then extended to cover copper-nickel-chromium plated aluminum, cadmium plated steel, zinc plated steel, copper-nickel-chromium plated zinc base die castings, and rust inhibiting oils and compounds on steel.

Figures 1, 2, and 3 illustrate the corrosion developed on various basic materials with different types of plating, and various plating thicknesses, when exposed to "Cass Test," acetic acid spray, and to the neutral salt spray. Table 1 shows the plated items with film thicknesses and the minimum "no failure" hours and the desired "no failure" hours.

The "Cass Test" may be used with two different rating methods. First, the test may be used as a passed or failed yardstick in which the parts tested must meet a standard in a given number of hours.

PANEL CODE	NORMAL(HRS)	ACETIC(HRS)	ACCELERATED					
			3	6	12	24	36	48 (HRS)
5-1	8	192						
5-2	32	192						
5-3	40	192						
5-4	48	192						

Fig. 3. Comparison corrosion of zinc plated steel under various salt tests.

TABLE 1
Recommended Acceptance Standard on Anodizing and Plating to be Used with Accelerated Salt Spray Test

G.M. Spec.	Base Metal and Type of Plating	G. M. Plating Code	Total	Minimum Plating Thickness, Inches			Accel. Salt Spray (*) Min. hours	Accel. Salt Spray (*) Desired hours
				Copper	Nickel	Chrome		
4251M	Cu-Ni-Cr on Steel	75	0.00075	Bal.	0.0002	0.00001	6	12
		100	0.0010	Bal.	0.0004	0.00001	12	24
		150	0.0015	Bal.	0.0005	0.00001	18	36
		200	0.0020	Bal.	0.0006	0.00001	24	48
4251M	Cu-Ni-Cr on Zinc Base Die Castings	75	0.00075	0.0002	0.0002	0.00001	3	6
		100	0.0010	0.0003	0.0004	0.00001	6	12
		150	0.0015	0.0003	0.0005	0.00001	9	18
		200	0.0020	0.0004	0.0006	0.00001	12	24
	Cu-Ni-Cr on Aluminum	75	0.00075	0.0002	0.0002	0.00001	2	4
		100	0.0010	0.0003	0.0004	0.00001	4	8
		150	0.0015	0.0003	0.0005	0.00001	6	12
		200	0.0020	0.0004	0.0006	0.00001	8	16
4251M	Ni-Cr on Brass Bronze or Copper	20	0.0002		0.0002	0.00001	6	12
		40	0.0004		0.0004	0.00001	12	24
		50	0.0005		0.0005	0.00001	18	36
		60	0.0006		0.0006	0.00001	24	48
4252M	Zinc on Steel	10	0.0001				3	6
		15	0.00015				6	12
		20	0.0002				12	24
		30	0.0003				24	48
		50	0.0005				36	72
4252M	Cadmium on Steel	10	0.0001				24	48
		15	0.00015				36	72
		20	0.0002				>48	>96
		30	0.0003				>48	>96
		50	0.0005				>48	>96
4407P	Anodized Aluminum	08	0.00008				3	6
		10	0.00010				3	6
		15	0.00015				6	12
4263P		20	0.00020				6	12
4273P		30	0.00030				9	18
4261P		40	0.00040				12	24

NOTE: (*) Part tested shall show no evidence of failure at end of specified hours of test.

This method is illustrated in the hours columns of Table 1; these standards may be refined as the use of this test gains increased acceptance. Second, a part may be rated according to Table 2 where a numerical value is assigned, and these used in defining specification limits.

To those who have investigated the salt spray test it is readily apparent that no real correlation was ever developed between service life and the duration of the normal salt spray test. In addition, it is known that this test will not differentiate between the corrosion characteristics or quality of the samples tested, but is merely a measure of the gross porosity of the plating. In 1954, Committee B-8 of the American Society for Testing Materials reported that tests have shown that the Neutral Salt Spray, "ASTM-B-117, does not reliably and reproducibly prognosticate the quality of plating finishes under consideration. Its value as a standard acceptance test is questionable, in view of the wide divergence of test results obtained on specimens presumably plated to the same thickness by the same plater and tested by the same laboratory."

Further it was found that this test lacked correlation amongst testing laboratories.³

Based on three separate but limited studies, *W. D. McMaster*² has indicated service life expectancy of plated parts as related to acetic acid salt spray test hours. Extensive data have not been established because of the limited use of this test. We are aware that some General Motors Divisions have made significant plating quality improvement, as did we, using the acetic acid salt spray as a guide. The correlation among testing laboratories has been proven and those laboratories that have used this test are convinced that it will differentiate between various plating qualities but, in view of the time required for the acetic acid salt spray test, it is probable that it will remain more or less a research method.

We believe that the Copper Accelerated Salt Spray—"Cass Test" is suitable for a rapid test in evaluating plating quality and predicting potential field failures of plated parts. Judging by the appearance of panels and parts exposed outdoors, the corrosion occurring during this test is more characteristic of outdoor cor-

Table 2
Corrosion Evaluation Procedure for Plated and Anodized Parts (Durability Rating)

1.	Specimens are checked at the end of the specified exposure period.			
2.	Interpretation of failure of specimens is as follows:			
<i>Corrosion of Basis Metals</i>				
Plated steel specimens—red dust				
Plated zinc-base die-castings—white corrosion products or blisters				
Anodized aluminum—pitting or white corrosion products				
<i>Appearance of Surface</i>				
Pitting, cracking and corrosion spots are failures which should be identified in the rating when objectionable.				
3.	<i>Rating Method</i>			
	<i>Rating</i>	<i>Extent of Failure</i>		
	100	No evidence of failure		
	96	1% of area failed		
	92	2% of area failed		
	88	3% of area failed		
	84	4% of area failed		
	80	5% of area failed		
	60	6-25% of area failed		
	40	26-50% of area failed		
	20	51-75% of area failed		
	0	76-100% of area failed		

rosion than that of corrosion occurring during the acetic acid salt spray. For three car model years Cadillac has used the Cass Test for both quality control and for research investigations of factors that affect the quality of anodized and plated parts. Many factors have been presumed to affect the quality of anodizing and of plating with copper-nickel-chromium that still provide scope for further investigations. The Cass Test should greatly speed up the development of plating from an art to a science. This test is now ready for general use as a basis for specifications. As previously stated, there are many uncontrollable variables that occur in service and affect the durability of plated parts on automobiles. To attempt to relate all of the variables encountered by plated automobile parts in service conditions to an individual corrosion test is presumptuous. The important factors that must be considered are that the Cass Test has excellent reproducibility, is a rapid test, produces the characteristic type of corrosion failure encountered in service, and measures the durability quality of metallic and non-metallic finishes.

Reproducibility of this test among laboratories has been investigated by General Motors in several round-robin test programs. The degree of correlation of test results within the same laboratory and among different laboratories is excellent. These round-robbins have also indicated that accurate control of test conditions previously outlined must be maintained. Just as in any chemical test or analytical procedure, variables must not be introduced promiscuously — those who desire to use this test as a tool to predict plating

quality and durability must be prepared to maintain the specified test conditions on pH, temperature, saturator tower levels, and water quality, etc. It may be of interest that Cadillac recently has added to the salt spray equipment a deionizer that automatically controls the level and quality of the water in the saturator tower.

Experimental work with the salt spray test has been quite extensive in the company during the past three years. Many factors which previously were not suspected of influencing reproducibility of this test have been isolated and patiently evaluated. Hence, the re-emphasis of maintaining test conditions. Recent work among five cooperating laboratories points the finger at a variable which, no doubt, has been responsible for the lack of correlation of salt spray test data amongst various laboratories. This variable is the preparation of parts or specimens for salt spray test. Most of us are aware that salt spray test methods outlined in ASTM publications make the following general reference to preparation of test specimens: "Metallic and metallic-coated specimens shall be suitably cleaned. The cleaning method shall be optional depending on the nature of the surface and the contaminants, except that it shall not include the use of abrasives other than a paste of pure magnesium oxide nor of solvents which are corrosive or which deposit corrosive or protective films." If those that use the salt spray test for evaluating plating quality were questioned we would find extremes from no cleaning of test specimens to the use of a countless number, types, and breeds of cleaning agents. An investigation on the effect of various cleaning agents on salt spray plating durability was made at Cadillac. Of a small number of materials investigated, the following were found to affect salt spray plating durability; magnesium oxide, a household scouring powder, chromic oxide, a reputable automobile cleaner-polish, and aluminum oxide. No doubt, there are countless other materials which would do the same. A comparison round-robin was recently conducted in the corporation on the effects of using a slurry of pure magnesium oxide vs. Bon Ami powder as the cleaning agents on copper-nickel-chromium plated specimens. The results were astounding. In all cases where magnesium oxide was used, plating durability was less. Which of these cleaning agents is distorting the salt spray plating durability picture? Are the panels prepared with Bon Ami clean, or does this material leave behind a protective film? Is magnesium oxide abrading the surface; does it leave behind a compound which causes a chemical reaction; or does it leave the surface of the specimen cleaner and more susceptible to corrosion? The aforementioned questions are currently troublesome but there is confidence that they will be resolved in a plating durability round-robin which is currently undertaken to correlate salt spray (Cass Test) with out-of-doors durability.

Do these and other cleaning agents have the same effect on plated parts cleaned by the customer in service? Is this the factor that constantly distorts the field picture or plating durability? Are not these questions food for thought?

As previously mentioned, the Cass Test was de-

signed as a means of measuring and prejudging out-of-door durability of chromium plated steel and zinc alloy parts. It is being used for this purpose, and is increasingly being used as a method for prejudging out-of-door performance of other surface protection systems such as cadmium, zinc, anodized aluminum and painted surfaces. This test has been related to part exposure of a copper-nickel-chromium system over steel and zinc die-castings in the Detroit area and it is the author's conclusion that 30 hours of exposure in the Cass Test is equivalent to one year's service. This information correlates that of other investigators,⁷ and is continuing in Detroit and other areas.

Now, as to reliability, it may be stated that this test has been used by a number of General Motors Divisions for two and three years. Comparisons have been made of Cass Test results with service performance of plated automotive parts after approximately one winter of service. In general, it may be stated that there is good correlation. There have been isolated cases on some individual parts where correlation has not been good. It is the author's opinion that this is to be expected. By way of explanation, a part may show poor performance in the Cass Test but, by favorable placement of the part on the automobile in service, it may show good durability; the converse may be true and, by way of justification, it should be noted that most laboratories using this test as a quality control tool are evaluating plated parts after 16 hours of Cass Test. Previously we indicated that 30 hours of this test more nearly represents a year of service in the Detroit area.

Many accelerated plating durability tests were carefully studied in various laboratories during the past few years. This presentation has covered in detail one of two tests that has weathered the storm and received widespread acceptance. The author would be remiss if he did not say that the Corrodkote Test shares an equal spotlight as a tool for evaluating decorative plating quality and durability. The fact that these two tests have acquired their present stature in the industry in such a relatively few years is due, in no small measure, to both the automobile manufacturers and the concerns supplying the plating industry. Perhaps the most remarkable result of the introduction of the Cass Test and Corrodkote Test has been the tremendous upsurge in plating research aimed at improving out-of-door durability of plated finishes. To a degree, this research is due to a justifiable concern by the platers in the general increasing usage of decorative materials that do not require plating to achieve appealing appearance and durability. But, to a larger degree, it is felt that the progress that has been made in the plating industry has been possible because, at long last, tools were available that make it possible to meaningfully

evaluate plating variations in a reasonably short period of time. To quote C. F. Nixon,⁸ "It is not an exaggeration to say that the Cass Test and Corrodkote Test are stimulating a revolution in the plating industry."

Based on present knowledge and current progress of the plating industry the expected durability of Cass Test hour durations is outlined in Table 1 and are realistic for each type of plating. As plating improvements are made, these requirements will change with the objective of economically putting into the field a plated part that will be relatively corrosion-free for the life of the automobile. It should be noted that, in present plating specification thinking, primary importance attaches to performance in accelerated testing, while plating thickness requirements tend to recede to secondary significance.

Recent developments in the plating industry, namely two successive layers of nickel plating and increased thickness of chromium, including the manner of its deposition, have been indicated to increase profoundly plating out-of-doors durability. This increase in durability has also been reflected on the increased number of Cass Test hours required to indicate failure of parts plated by these systems. Is the Cass Test obsolete? Not by a long shot, but this does indicate that further acceleration of a test to evaluate plating durability will soon be required.

Bibliography

- C. H. Sample, Report of Subcommittee III on Conformance of Salt Spray Test, Proceedings Amer. Soc. Testing Materials, **43**, 187 (1943).
- E. M. Baker, Factors Underlying Specifications for Electro-deposited Metallic Coatings, Proceedings Amer. Soc. Testing Materials, **43**, 191 (1943).
- L. J. Waldron, Basic Requirements in the Standardization of the Salt Spray Corrosion Test, Proceedings Amer. Soc. Testing Materials, **44**, 654 (1944).
- V. M. Darsey and W. R. Cavanagh, Apparatus and Factors in Salt Fog Testing, Proceedings Amer. Soc. Testing Materials, **48**, 153 (1948).
- Report of Subcommittee B-3, Proceedings Amer. Soc. Testing Materials, **54**, 147 (1954).
- C. F. Nixon, A Modified Salt Spray Test for Chromium Plated Zinc-Base Die-Castings, The Monthly Review, No. 32, 1104, Nov. 1945.
- W. D. McMaster, The Five Percent Salt Spray and Its Acetic Acid Modification, Plating, July 1955, ASTM Bulletin, January 1955.
- Report of Committee B-8, Proceedings Amer. Soc. Testing Materials, **54**, 299 (1954).
- Handbook of Chemistry and Physics, Chemical Rubber Publishing Co., 32nd Edition, pp. 1521-23.
- O. Bauer, O. Krohnke and G. Masing, Die Korrosion metallischer Werkstoffe, I, 240, S. Hirzel, Leipzig, (1936).
- G. L. Cox, Ind. Eng. Chem., **23**, 902-904 (1931).
- W. Safranek, H. Miller, C. Faust, New Finishes for Zinc Die Castings, Battelle Memorial Institute, Feb. 1, 1959.
- C. Nixon, J. Thomas, D. Hardesty, Experiences with the Copper Chloride Modified Acetic Acid Salt Spray. Report GMR-216, General Motors Corporation, June 17, 1959.

Do You Appreciate the Dilemma of Depreciation?

By Irving Elbaum, C.P.A., Los Angeles, Calif.

Q: The word "depreciation" seems to have different meanings to different people in our field. Would you be good enough to give us the accounting approach?

A: The accountant (and, for that matter, the income tax agent as well) understands depreciation to be a reasonable allowance for the wear and tear of property used in a business. In this way it differs from the ordinary concept of the term which is generally accepted to mean a decline in the market value. One other point — generally the factor of obsolescence is also included in any estimate for depreciation. This is understandable when one stops to consider that the probable useful life of a piece of equipment can be shortened appreciably by changes in economic conditions, loss of trade, new inventions, prohibitory laws, etc.

Q: Since no cash is involved in depreciation isn't it, in effect, just a bookkeeping entry?

A: True, it is a bookkeeping entry. However, it is an extremely important one. Even though no cash outlay is involved for any given year's depreciation, it is vital to realize that unless the records of the business provide for depreciation for each of the years in the estimated life of the rectifier, for example, the day will come when it will have to be replaced and there may not be enough cash left over from the profits of the business to buy a new one. It is important therefore, to recognize that, although this item of depreciation in a sense may be considered to be invisible in any one year, it certainly isn't invisible when the cash has to be laid out for the new rectifier after the old one has served its purpose.

Q: Could you go into a little more detail as to how the entry of depreciation helps to provide for the purchase of a new degreaser?

A: Let us suppose that your business showed a profit of \$25,000 for the year 1959, without considering the item of depreciation. You might consider, therefore, that you increased your net worth by that amount of money, whereas, actually you might have increased your net worth by only \$22,000, assuming

that there really was \$3,000 of depreciation which you had neglected to record on your books. In other words, you would really be fooling yourself to the extent of that \$3,000 item and you would be rudely awakened when, after a while, you had to buy a new degreaser to replace that which had already depreciated. If you hadn't held back enough cash from the profits of the years during which the original equipment was being depreciated, you would find that you would be faced with a problem of obtaining sufficient cash when the new equipment would have to be bought. Naturally, this could be a great economic shock to your business.

Q: How do I go about determining the expected life of a sander?

A: There are a few ways in which this can be done. The manufacturer of the equipment can give you his estimate of the longevity of the sander. The Internal Revenue Service, by means of its Bulletin "F", indicates that the expected longevity of a sander is approximately 16 years. Bulletin "F" is presently being revised, but the finished product will not be available for some time.

Q: Am I necessarily obligated to use as the estimated longevity of a polishing lathe the figure that the manufacturer gives me or the figure that Internal Revenue suggests?

A: No. In the final analysis you are the one who will make the decision as to the number of years over which you feel it is fair and reasonable to write off the cost of the polishing lathe, less salvage value."

Q: Just what does that mean?

A: Salvage value means the amount you expect to recover from the sale of the machine at the end of its useful life. Of necessity, this has to be a guess, but try to make it an educated guess rather than picking a figure out of the blue.

Computing Depreciation

Q: What are the basic methods for computing depreciation?

A: In the metal finishing field the ways to compute depreciation are: the straight-line method, the

sum-of-the-years-digits method, and the declining-balance method. Let us spend a little time on the general description of each of these. The straight-line method, which is a fairly popular one, is predicated on the assumption that wear and tear are uniform during the useful life of the equipment. Therefore, the cost of the item less its estimated salvage value is depreciated in equal amounts over the estimated useful life. Both the sum-of-the-years-digits method and the declining-balance method are predicated on the assumption that the depreciation is higher in the early years and lower in the later years of the life of a piece of equipment. The years-digits method works as follows: different fractions are used each year against the original cost, less salvage value. The numerator of the fraction represents the remaining useful life of the item each year and the denominator, which always remains the same, represents the sum of the digits of all the years corresponding to the estimated longevity. For example, if the piece of equipment has an estimated life of four years the denominator of the fraction would always be 10, since 4 and 3 and 2 and 1 equal 10. For the first year 4/10 of the cost (less salvage value) would be depreciated, 3/10 in the second year, etc. Under the declining-balance method of depreciation the depreciation base is lowered each year by the amount of the depreciation deduction and a steady rate is applied to the balances that result. Under federal income tax provisions, this declining-balance rate may be as high as 200% of the straight-line rate.

Q: Could you perhaps show a numerical comparison of these methods?

A: Surely. The tabulation below shows for each of the three methods the annual depreciation charge as well as the accumulated depreciation up to the end of any given year. The basic facts used in the preparation of this table are as follows: it was assumed that a group of equipment cost \$10,000 and had a negligible salvage value. It was estimated that the useful life of the items would be four years.

Year	Straight-line		200% declining-balance	
	Annually	Accumulated	Annually	Accumulated
1	2,500	2,500	5,000	5,000
2	2,500	5,000	7,500	7,500
3	2,500	7,500	8,750	8,750
4	2,500	10,000	9,375	
	Sum-of-digits	Accumulated		
	Annually	Accumulated	Annually	Accumulated
	4,000	4,000	5,000	5,000
	3,000	7,000	2,500	7,500
	2,000	9,000	1,250	8,750
	1,000	10,000	625	9,375

It will be noted that, under the straight-line and sum-of-the-digits methods, the accumulated depreciation is \$10,000 at the end of the fourth year, whereas, under 200% declining-balance method, the accumulated amount is only \$9,375. The balance can be handled in one of two ways. Since the income tax law allows a taxpayer to switch from the declining-balance method to the straight-line method at any time without the consent of the Commissioner of Internal Revenue it would be a wise idea for the taxpayer in this situation to switch from this declining-balance method to the

straight-line method after the end of the third year. Another alternative would be to depreciate the group in the amount of \$1,250.00 in the fourth year of the group's life if the assets were abandoned by the end of that year.

Q: In addition to serving as documentation in the event of an income tax audit, what other useful purposes are served by depreciation records?

A: Records of depreciation are invaluable in cases of loss, where one is trying to prove to the insurance company what the values of the damaged items were. In addition, personal property tax and sales tax audits are greatly facilitated by bringing into play accurate and up-to-the-minute depreciation records. When either the entire business is to be sold or when a given piece of equipment is to be sold, it is sometimes vital that the prospective purchaser know what the cost, the annual depreciation, the accumulated depreciation, and the salvage value factors are.

Q: We have two double action barrels. Must we use the same depreciation method for both, assuming that they are both new in use with us and that they have an estimated useful life of 3 years or more?

A: Not at all. You may depreciate one under one depreciation method and you may depreciate the other under an entirely different one.

Q: Suppose I had a bad year in my business in 1959 and did not choose to deduct depreciation. Would I, therefore, be allowed to deduct twice the amount I normally could in the year 1960?

A: No. The law is so worded that the deduction for depreciation is limited to the amount that was allowed or allowable. Since depreciation for 1959 in your case was allowable, even though you chose not to take that deduction, you would never be able to recover the depreciation for that year.

Q: Is there anything I can do to guarantee that the depreciation rate I picked for my automatic plater will not be upset by the Internal Revenue Service at a later date?

A: Yes. According to the law you can make an agreement with the Commissioner of Internal Revenue establishing the depreciation rate which will apply to either a given piece of equipment or to a group of machines. This works very advantageously in that it helps to avoid future friction between the taxpayer and the Internal Revenue Service.

Q: A competitor told me recently that he figures depreciation on his metalizer exactly to the day. Must I, for managerial purposes and/or income tax purposes, do the same thing?

A: No. If you'd like, you can do as follows: any equipment bought during the first half of the month can be considered to have been bought as of the first of that month, any equipment bought during the last half of a month can be considered to have been bought as of the first of the next month. Some firms feel a simple way to handle additions and subtractions of equipment that occurred during the year is to assume that they took place as of the mid-point of the taxpayer's year, namely July 1st in the case of a calendar year taxpayer.

Q: Where on my profit and loss statement must I show the expense for depreciation?

A: There is no one place where the item of depreciation *must* be shown on a profit and loss statement. For example, some firms in your field like to show depreciation as part of the regular operating expenses. Others like to show it as a separate item after the normal operating profit. The important thing to remember is that depreciation, at all costs, must be shown somewhere in the profit and loss statement, since it is one of the vital cost factors.

Q: Every so often I like to figure my breakeven point. Naturally, in order for me to be able to do that, I must know what is my overhead. Is it really important for me to include depreciation as an item of overhead?

A: Absolutely. Although depreciation, in a sense, is invisible it is also insidious. As each page on the calendar is destroyed, the depreciation on a piece of equipment becomes greater. If you allow yourself to be deluded by the fact that it is not important to include depreciation as an item of overhead because no cash outlay is involved, you will be fooling yourself to the extent that you will be understating your total overhead. Furthermore, although an immediate cash outlay is not involved with depreciation, obviously money will have to be paid out in the future. Depreciation merely acts as a convenient method for reducing the profit per the books to such a level that, when the day comes (as it ultimately must) that a new piece of equipment has to be purchased, there will be enough funds in the business to be able to do so.

Income Tax Benefits

Q: I've been hearing quite a bit about some new income tax benefits in connection with the depreciation deduction. Would you review the salient points?

A: The new tax law gives a business the option of using a one-shot benefit which amounts to a flat 20% of the cost of the item. The item must be personal property (thus, excluding buildings) which is used in a business or for income-producing purposes. The equipment must have an estimated useful life of 6 or more years and have been acquired after December 31, 1957. The items can be new or used. The flat 20% is figured on the cost, no provision having to be made for the estimated salvage value. The maximum amount allowable is \$10,000 (or \$20,000 for married taxpayers filing a joint return) in any one year.

Q: Does this new depreciation replace the speedy

methods (declining-balance, sum-of-digits) we used on last year's tax return?

A: No. The new flat 20% is in addition to any regular or speedy method. However, it is important to recognize that the speedy methods you have been using cover *new* property that has an estimated longevity of 3 or more years, and that is either personal or *real* property. Notice how much more limiting the new provisions are.

Q: Suppose I want to use the 20% provision on a filter which I bought July 1, 1959. Must I prorate the 20%, since I only had the filter for 6 months in 1959?

A: No. This 20% deduction is allowed even if you had the item for only 1 day during the year. As a matter of fact, the 20% can even be deducted if the filter were sold during the year.

Q: My business is run through two corporations. Am I entitled to a maximum of \$10,000 or \$20,000 as the 20% deduction in each corporation, since I file a joint return with my wife each year?

A: Since a corporation cannot file a joint return, the limitation is \$10,000. Of course, each corporation is entitled to its \$10,000 potential maximum.

Q: I think it would be wise if I could see an actual illustration of these new pointers. Please show me.

A: Suppose the firm bought some equipment on July 1, 1959 with an expected life of 8 years, and costing \$4,000. If the straight-line method is used (assuming the equipment was used), the firm would be entitled to \$1,000 as its first year's depreciation deduction. This is calculated as follows:

Flat 20% of \$4,000	\$ 800
\$3,200 (\$4,000 less the \$800) multiplied by	
1/8 (since there is an estimated life of 8 years)	
multiplied by 1/2 (since the items	
were bought on July 1st	200
Total	\$1,000

If the declining-balance method is used (assuming the equipment was new) the firm would be entitled to \$1,200 as its first year's depreciation deduction. This is calculated as follows:

Flat 20% of \$4,000	\$ 800
\$3,200 (\$4,000 less the 800) multiplied by	
1/8 multiplied by 1/2 multiplied by 2 (since	
this is the 200% declining-balance method)	400
Total	\$1,200

Infra Red Baking of Organic Finishes

By G. J. Marotta, Western Electric Co., Merrimack Valley Works, North Andover, Mass.

MOST baking enamels which are composed of thermosetting resins cure by oxidation and/or polymerization at temperatures usually above 250°F. The sources of heat vary considerably, with those most commonly employed being found in either of the two following classifications, viz., convection oven and radiant oven. Our experiences with the latter at the Merrimack Valley Works will be reported in this paper.

In planning an organic finishing area for the new plant in North Andover, Mass. in 1955, the engineer group was confronted with the problem of floor space limitations combined with the need for a conveyorized spraying and baking unit. The highly undesirable condition of dust-laden air and particles collecting on freshly painted surfaces, as had been the previous experience at another local plant, could not be tolerated in the new plant. This difficulty has been effectively overcome by the construction of an airtight sealed room for organic finishing, which is maintained under a positive air pressure head of approximately 1" of water column by three make-up air blowers which supply air to the room through a maze of fiberglass filters. These units are shown in Fig. 1; the floor to ceiling walls and power operated doors are also shown. Fig. 2 shows the automatic dampers which open at a predetermined pressure to maintain the pressure gradient within the room at a constant level above atmospheric. Fig. 3 is a view of the infrared baking oven, one of the wet wall spray booths, and the overhead conveyor. Fig. 4 is a picture of the conveyor path between the two spray booths of this unit and its travel on to the infrared oven. The windows overhead are airtight and caulked to prevent dust and dirt from entering from outside. Fig. 5 depicts the same area and demonstrates the effect of light emitted from the oven in operation.

Parts to be finished are lightly tacked-off, to remove any dust or residue loosely adhering on the surfaces after phosphating, then hung on the overhead conveyor which is travelling at a speed of 2½ feet per minute. The parts are painted by hot spray-

ing in either of the two booths, or both, if the parts require finish on all sides and are too large to be rotated on the conveyor swivel hook. A recirculated hot water heat exchanger system is used for paint heating in this arrangement. After travelling between 18 to 30 feet, depending on which booth is in use, or a flash off time of 7 to 12 minutes which is fairly complete for the low solvent content hot paint, the parts are baked in the infrared oven. Fig. 6a shows the oven lamps on low voltage, while Fig. 6b shows the oven on full voltage. The panels are being revolved in the oven by the action of a wheel turning against an angle-iron bar alongside the conveyor. This wheel is part of the swiveling suspension of each hook spaced on 12" centers. The maximum width that can be rotated is 32" due to the limitations imposed by spacing of the two banks of lamps.

By varying the input voltage we are able to gener-

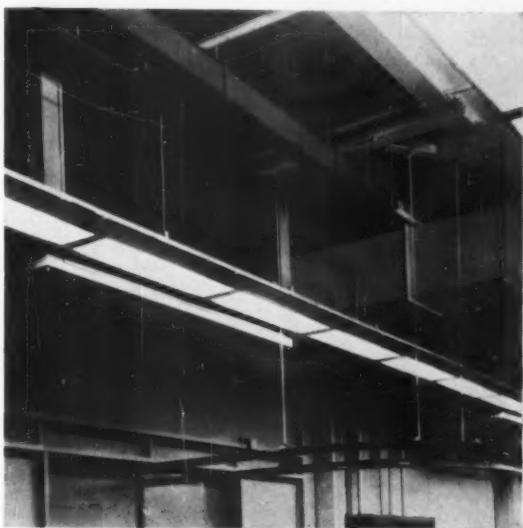


Fig. 1. Fiberglass filter through which air is carried into the finishing room.

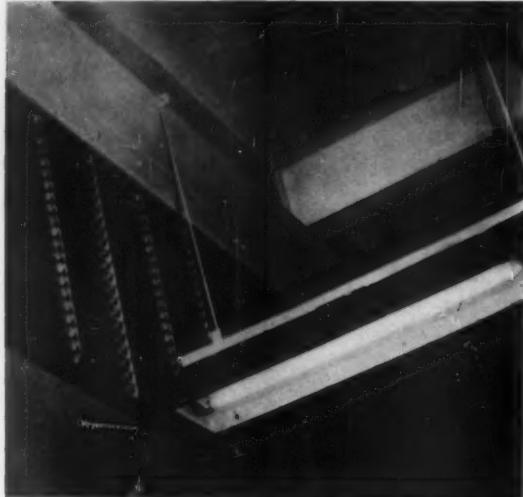


Fig. 2. Automatic dampers which maintain predetermined air pressure level in finishing room.

ate full wattage on high and one-third wattage on the low setting. This accomplishes varying metal and average film temperatures, depending on the percentage of the time cycle that full voltage is impressed as compared to the half voltage. Fig. 7 is a closer view looking into the oven on high voltage. Fig. 8 shows the percentage input controller which may be set for any increment up to 100% of a thirty second interval during which the lamps are on full voltage. During the balance of the time cycle the voltage is reduced to half. This is the only control normally required to adjust operating conditions for each variety of work being processed. Its effect appears to be instantaneous and accurately reproducible, as will be shown later.

The oven is of standard design. It is 22 feet in length and contains 288 infrared lamps which are all of the 375 watt size, except those of the bottom row on each side which are composed of 24 lamps, each of 500 watt rating. The purpose of this latter arrangement is to provide additional heat in the zone of the oven where the cooling effect of rising air cur-

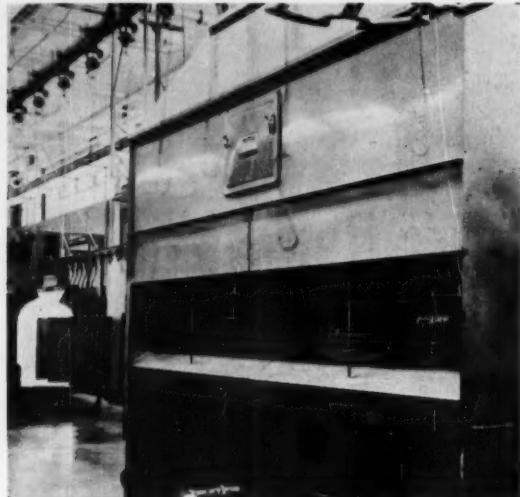


Fig. 3. Wet wall spray booth in foreground and infrared oven in background.

rents frequently is appreciable. In addition to the input controller, further control may be exercised by maintaining half voltage on one of the three longitudinal divisions of the lamp banks which may be maintained as a low voltage zone continuously while the other two radial zones are alternating high and low based on the input controller setting. The two banks of lamps are spaced 48" apart and measure 57" vertically. There are two rows at the top and one at the bottom which are positioned at angles to the vertical banks in order to direct rays on the top and bottom surfaces of the parts being baked. The lamps are individually mounted in multi-surfaced reflectors in order to permit diffusion of the rays generated in all directions. They are gold plated for maximum reflectivity of the infra red band, which is 98% in the case of gold. In addition, gold plated baffles are used at both ends of the oven to prevent loss of radiant energy through spillage out of the ends.

The cost of this baking unit was \$12,500, installed. This type was chosen primarily due to limitations imposed by available floor space. Other advantages

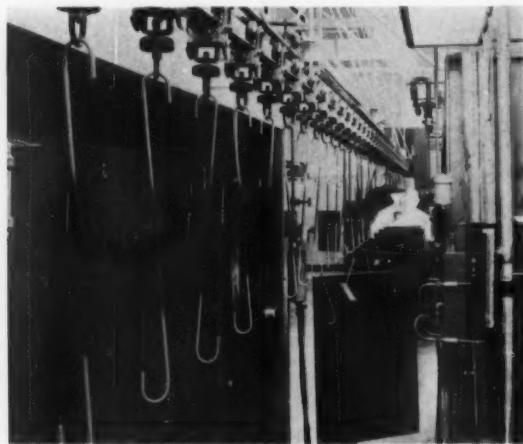
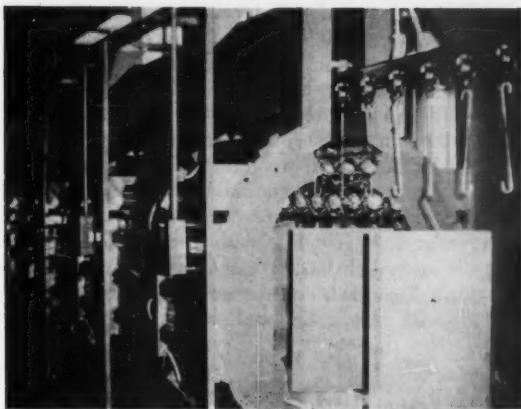


Fig. 4. Conveyor path between two spray booths.



Fig. 5. Infrared oven in operation.



A



B

Fig. 6. Parts entering the infrared oven; (a) is on low or half voltage, (b) is on full voltage.

became apparent after it was put in use. Outstanding among these was the fact that parts are baked in clear air, as no air circulation is necessary for proper baking and the only air brought in contact with the tacky surface of the film during curing being that which is circulated by the blower exhausting released solvents. The electrical contactors are tied in to the conveyor controls so that a stoppage of the conveyor immediately results in a power input drop from full to $\frac{1}{3}$ wattage. In this manner it is less likely to over-bake or burn the types of finishes being processed. This, too, is an advantage of using a tungsten filament lamp, which instantaneously acquires incandescent temperature of approximately 4000°F. at full voltage and drops to approximately 3400°F. at half voltage. These lamps, radiating in the near infrared wave length range of 1 to 2 microns, effect practically no intermediate air heating, as the rays are transmitted almost 100% by air at such wave lengths. The instantaneous response to voltage changes in these

sources of radiant heat permits reproducible operating conditions and results. The lack of air heating makes for high over-all efficiency. In addition, no insulation of the oven walls was required, since radiation is continually reflected from side to side with no appreciable heating of the oven walls. The ambient temperature is affected solely by the heat dissipated into the room from the heated parts cooling after leaving the oven. In a confined space of little more than 3000 square feet, the rise in room temperature from heat dissipated into the surroundings by a conveyorized convection oven would be of some concern.

To develop a basis of comparison between the conventional batch type convection oven and the infrared oven, data were compiled on the rate of temperature rise in both ovens. The corresponding rise in temperature of heavy gauge parts placed on a baking truck of a particular design which was full of trays, and having a close-packed arrangement in the case of the convection oven, and attached to the overhead con-

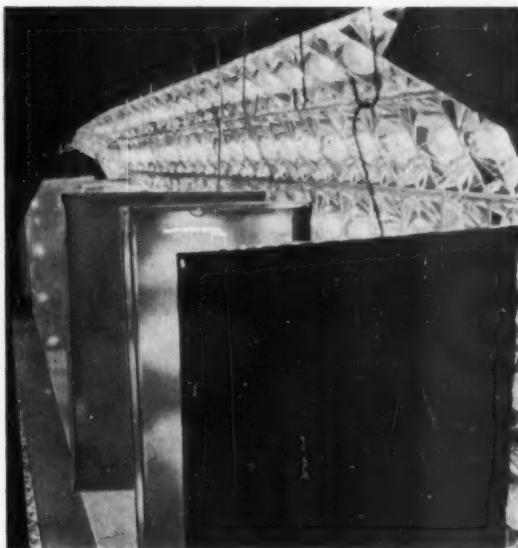


Fig. 7. Close-up view showing parts in oven at higher voltage.

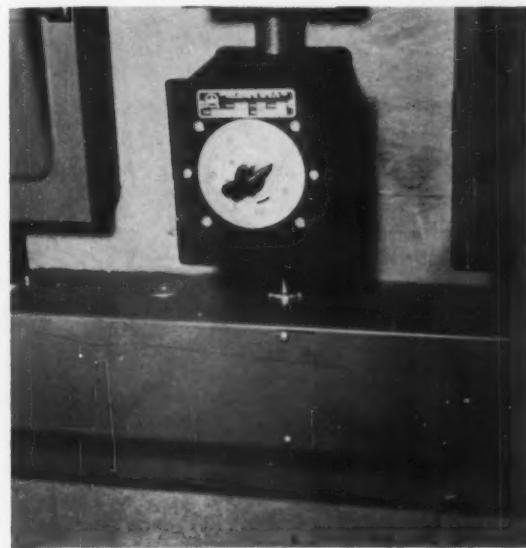
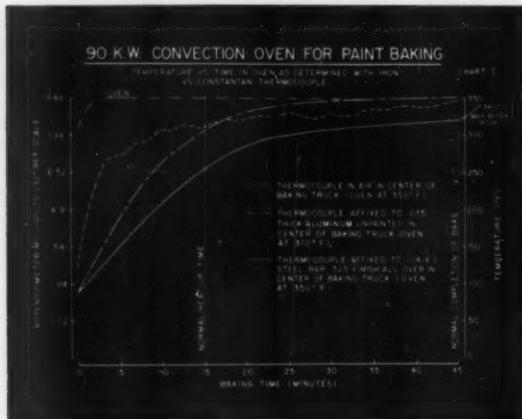


Fig. 8. Input controller for varying voltage-time relationships of the oven.



tinual heat generation by raising the temperature control to above 500°F., since the power was continually cycling on and off once 350°F. had been reached. Chart I shows the effect of this fluctuation in air temperature in the oven as registered by the sensitive iron-constantan thermocouple suspended in the center of the oven truck but in contact with no metal part. Chart II shows how this condition was eliminated with the thermocouple in air rising on a smooth curve, but even under these conditions the temperature of the part did not reach baking temperature until after 33 minutes had elapsed, and the air temperature reached 510°F., with the heating unit running continuously.

veyor in the case of the infrared oven, was determined. Chart I shows how the hot convection oven rapidly raises the temperature of the air flowing from its 90 KW electrical heat source to 350°F., the temperature usually employed in baking a particular enamel used in the tests. It was found that the temperature of the air in the center of the baking truck lagged far behind the controller bulb. The normal heat-up period of fifteen minutes was far from adequate as neither steel nor aluminum parts approached 350°F. by that time. The required bake at 350°F. for 25 minutes, which we assumed was easily being accomplished, was not being attained. Although some curing was taking place after a fifteen minute warm-up and until the 45 minute point was reached, just how much baking was being effected could not be determined. Even after one hour in the oven, 350°F. was barely approached by the heavy gauge steel parts. To further pursue this point, it was decided to maintain con-

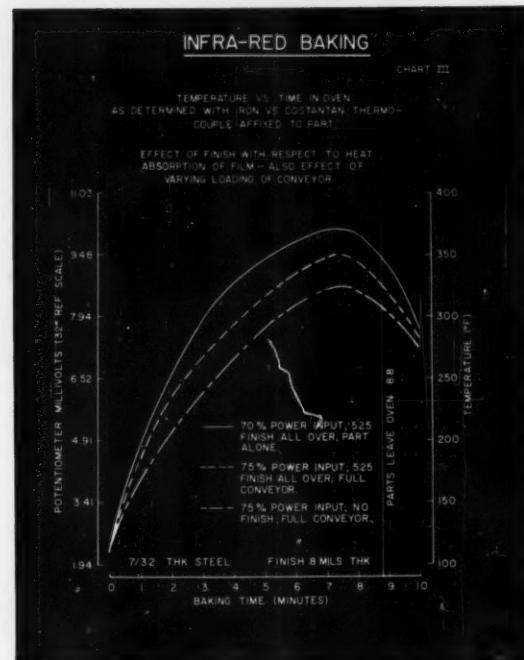
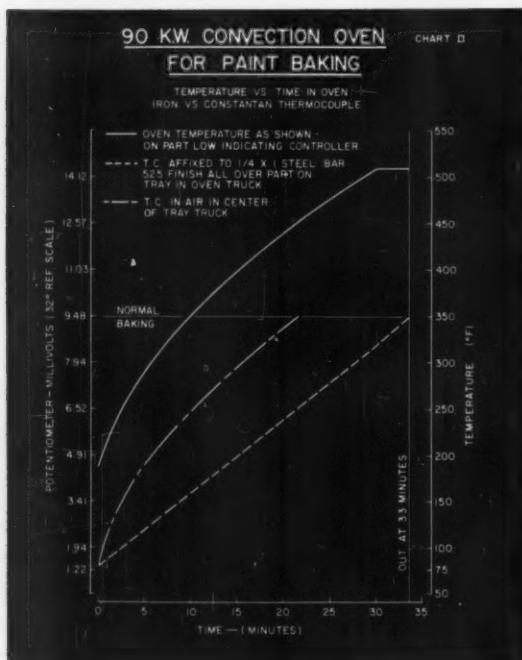
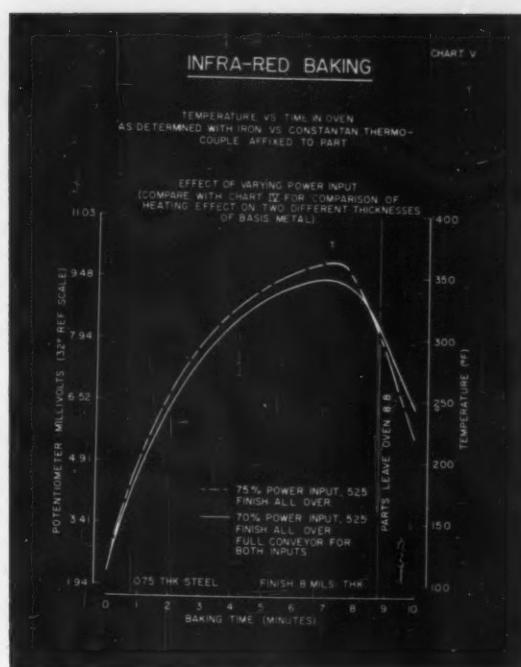
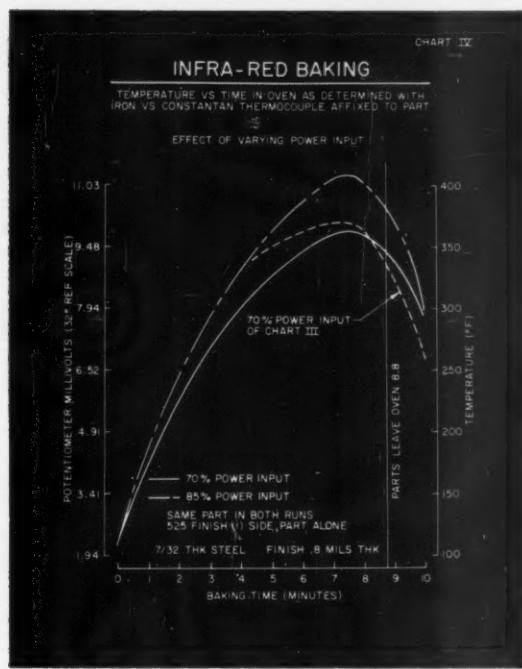


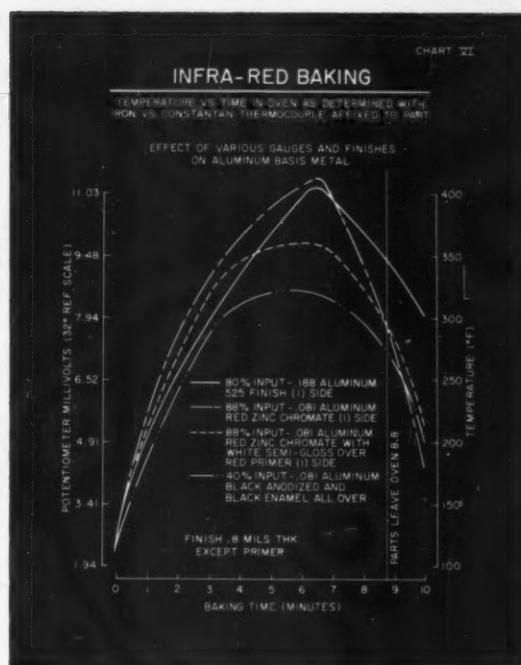
Chart III presents data obtained in the infrared oven. The same thermocouple was attached with masking tape to various parts tested. From these curves we can see the rapid rise in temperature of the film, rising to 250°F. within 3 minutes, 300°F. by the fourth minute, and well over 300°F. by the eighth minute. These curves also demonstrate the manner in which the presence of a paint film causes a higher rise in temperature due to the heat absorption of the film; how the input setting affects the peak temperature attained; and the effect exercised by other parts in the immediate vicinity of the part being tested. The part run alone in the oven receives radiated heat from all lamps in the oven, while the part checked on a fully loaded conveyor reaches a lower peak temperature due to the shielding effect of the neighboring parts.

Uniformity of results obtained were consistent in our tests, with reproducibility possible, due to the fact that each part was individually exposed on all surfaces to approximately the same radiation. The

"hotter" and "colder" zones experienced in the convection oven which caused some parts to overbake and some to underbake in the same batch of work appear to be less likely in this type of infrared oven. Chart IV further demonstrates the effect of varying the power input to the infrared oven. A phantom curve from Chart III is also shown to permit comparison of temperature rise on parts with a film on one side only, to parts with a film all over which reach a higher peak. Chart V shows further the manner in which input affects temperature peaks in the infrared oven. It also demonstrates, by comparison with the previous chart, that the same input setting will produce different peak



applicable specifications with regard to color and gloss, as measured on the Hunter Color Difference Meter; scratch adhesion as measured on the Balanced Beam Tester; and thickness, as determined both by the Magne-Gage and the dial indicator. The texture is sufficiently free of dirt and particles, and the matching of color from part to part of a particular run is satisfactory.



temperature in different gauges of the same metal dependent upon conveyor loading. The heavier gauge metal absorbed more heat, producing a higher average film temperature in this particular run, due mainly to the fact that the lighter gauge part was run in an oven with a full conveyor while the heavier part was run alone. Chart VI is composed of further data on the effects of gauge differences and also demonstrates the degree of reflectivity experienced with different colors. The peak temperatures attained with parts painted red and gray are to some degree higher than those obtained with a white finish. The part with a black finish with much lower power input approached the peaks reached by the other parts due to the 100% absorptivity of the radiant heat.

These tests indicate that more data must be compiled to answer all the questions that come to mind concerning infrared baking of organic finishes. It may be noted that hot sprayed finishes cured in this manner in our plant have consistently met the requirements of the

FINISHING POINTERS

Control of Watts Nickel Baths

By J. B. Mohler
Seattle, Wash.

BRIGHT plating from a Watts nickel bath, at high current densities, is dependent on good control. Since the bath is concentrated, drag-out losses are high. Also, the bath volume is subject to continuous change due to operation at elevated temperature. The total salt content, therefore, changes quite readily. This means that the nickel sulfate concentration becomes an important variable since it accounts for the majority of the composition of the bath. The total concentration and, therefore, the nickel sulfate is easily controlled by means of a hydrometer. Baths of this type have been maintained satisfactorily for years by this means.

The data of the table were taken to construct a control graph.¹ These data were since analyzed to fit the following gravity equation:

$$^{\circ}\text{Bé} = \text{NiSO}_4 \cdot 6\text{H}_2\text{O} \times 0.482 + \text{NiCl}_2 \cdot 6\text{H}_2\text{O} \times 0.47 + \text{H}_3\text{BO}_3 \times 0.54 + (85-T) \times 0.0217$$

where: concentrations are in oz./gal., temperatures in °F. and gravities in °Bé.

The measured and calculated gravity values show good agreement. The equation, therefore, was used to construct the graph.

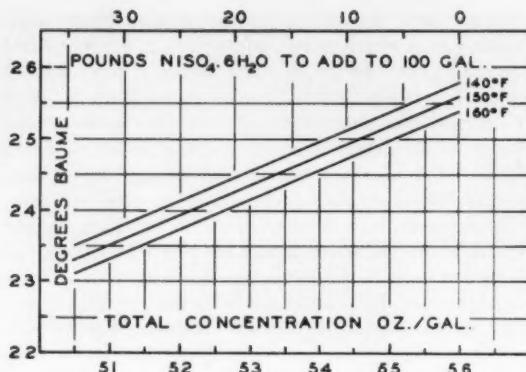
The following bath limits are suggested:

NiSO ₄ ·6H ₂ O	40.45 oz./gal.
NiCl ₂ ·6H ₂ O	5.6 "
H ₃ BO ₃	4.5 "
Total Concentration	51.56 "

Gravity at 160°F. 23.1 to 25.4 °Bé

NiCl₂ and H₃BO₃ are maintained by analyses for chloride and boric acid. Usually these can be held within recommended limits by analyses twice a month. The pH of the bath is checked and adjusted daily and addition agents are controlled by plating range tests once or twice a week depending on the bath.

The gravity of the bath should be checked daily. This only takes a matter of seconds since the hydrometer can be dropped directly in the bath. Occasionally the gravity reading will be low due to cooling of the bath overnight with consequent crystallization of salts. The bath should be brought to level, agitated, and gravity



readings taken until the reading is constant. From the gravity reading and reference to the graph an addition is read in pounds of nickel sulfate to bring the concentration to the high limit. Frequent additions of nickel sulfate are recommended. This is easy by the gravity method and an advantage, since large infrequent additions are known to cause trouble in bright nickel baths. This is due to minor impurities in the nickel sulfate and can be corrected by electrolyzing the bath. However, it can be avoided by frequent, smaller additions.

There is no need to analyze for nickel when a bath is controlled by gravity. Impurities will cause errors in the gravity readings but nickel baths will not tolerate large amounts of impurities such as zinc, iron, and copper that normally contaminate the bath. Therefore, gravity errors from these sources will be small.

This same general method can be applied to other acid baths to take advantage of the easiest of control means. Any plater can apply the method and it is a distinct advantage to place simple control facilities in the hands of the man doing the work. He begins to become aware of changes in the bath, of the importance of the bath level, and of the quantities of chemicals than can be lost by drag-out. Considering the benefits, is there any plating bath where one would not profit from gravity readings and a control graph?

Measured and Calculated Gravities of Watts Nickel Baths

NiSO ₄ ·6H ₂ O oz./gal.	35	40	45
NiCl ₂ ·6H ₂ O "	6	6	6
H ₃ BO ₃ "	5	5	5
°Bé 85°F. meas.	22.5	24.8	27.0
°Bé 120°F. "	21.7	24.0	26.3
°Bé 160°F. "	20.9	23.1	25.4
°Bé 85°F. calc.	22.4	24.8	27.2
°Bé 120°F. "	21.6	24.0	26.4
°Bé 160°F. "	20.8	23.2	25.6

Reference

1. Metal Finishing, 46, 53 (Feb. 1948).

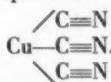
Science for Electroplaters

53. Complex Cyanide Baths

By L. Serota

COPPER (cuprous) cyanide is representative of a number of sparingly soluble compounds wherein the solubility is increased rather than decreased by the addition of a common ion. Thus, sparingly soluble monovalent copper cyanide, CuCN, will dissolve in solutions containing an excess of sodium or potassium cyanide, with dissolution resulting in the formation of the complex cyanide (coordination compounds).

G. Gabrielson notes that the present view regarding the structure of complexes in cyanide solutions, indicates attachment of the metal atom to the cyanide group through the carbon atom. The constitution, for example, of the copper complex, $\text{Cu}(\text{CN})_3^-$, would be represented as follows:



The principal methods of determining the formulas of complex ions in solution are based upon solubility, chemical analysis, freezing point lowering, electrode potential, resistivity, viscosity, spectrophotometry.

Complex Cyanide Composition

The composition and stability of the complex ions which form when cuprous cyanide is dissolved in solutions containing ions has been the subject of investigation for a long time. F. P. Treadwell found that precipitation of cuprous sulfide, Cu_2S , with hydrogen sulfide did not occur in solutions containing the complex cyanide ion when the ratio of cyanide ions to cuprous was greater than that required to form the complex $\text{Cu}(\text{CN})_2^-$. $\text{Cu}(\text{CN})_3^-$ and

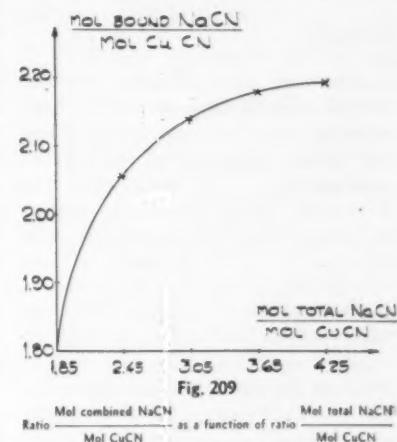
$\text{Cu}(\text{CN})_4^{\equiv}$ were considered the most probably complexes. The stability of the two latter ions is interpreted in terms of their dissociation constants. Thus, the metal ion concentration resulting from the dissociation of the complex cyanide ion when its composition is less than $\text{Cu}(\text{CN})_3^-$, though exceedingly small, will provide sufficient copper ions to exceed the solubility product of cuprous sulfide, so that precipitation of the sulfide will result. Solutions containing complex cyanide ions with the greater cyanide ratio, like $\text{Cu}(\text{CN})_3^-$ and $\text{Cu}(\text{CN})_4^{\equiv}$ however, have such low dissociation constants that precipitation of the sulfide will not occur. It was found, for example, that in such solutions the concentration of the cuprous ion is less than 10^{-21} g./l.

Other investigators, using electromotive force measurements, freezing point determinations, and electrometric titrations, led to the view that the principal complex ions present are $\text{Cu}(\text{CN})_3^-$ and $\text{Cu}(\text{CN})_4^{\equiv}$. S. Glassstone showed by electrometric titration that, when two equivalents of cyanide ion are added to one equivalent of cuprous cyanide, the copper will be present in the form of the complex $\text{Cu}(\text{CN})_3^-$. $\text{CuCN} + 2 \text{NaCN} \rightarrow \text{Na}_2\text{Cu}(\text{CN})_3$. Since this is the condition common to copper plating solutions, it is assumed that $\text{Cu}(\text{CN})_3^-$ is the principal ion, which Thompson calls the chief metal-bearing ion. The same investigator found that 1.5 equivalents of an alkali cyanide are required to dissolve 1 equivalent of cuprous cyanide, indicating the presence, under such conditions, of both complexes, namely $\text{Cu}(\text{CN})_2^-$ and $\text{Cu}(\text{CN})_3^-$.

Recently, H. P. Rothbaum, using data obtained with ultra violet absorption spectra, concluded that in the presence of sufficient cyanide practically all the copper is present in the complex $\text{Cu}(\text{CN})_4^{\equiv}$. When the copper to cyanide ratio is higher, about 0.32, such as is common to most plating baths, the principal ion present is $\text{Cu}(\text{CN})_3^-$; and, at higher copper to cyanide ratios, the complex ion $\text{Cu}(\text{CN})_2^-$ forms. The various complexes formed when cuprous cyanide is dissolved in alkali cyanide solutions may be represented as follows:
 $\text{CuCN} + \text{CN}^- \rightarrow \text{Cu}(\text{CN})_2^-$; $\text{CuCN} + 2\text{CN}^- \rightarrow \text{Cu}(\text{CN})_3^-$; $\text{CuCN} + 3\text{CN}^- \rightarrow \text{Cu}(\text{CN})_4^{\equiv}$.

Complex Ion Composition

The effect upon complex ions in copper plating baths of changes in pH, temperature, and concentration was investigated by Gabrielson. For changes in composition of the complex cuprous cyanide ion with increasing excess of alkali cyanide, 3.00 grams of cuprous cyanide, CuCN, were dissolved in 100 ml solutions containing concentrations of 3.00, 4.00, 5.00, 6.00 and 7.00 grams of sodium cyanide, respectively. The temperature in each case was 18°C. The alkali cyanide that remained uncombined in each run, the free cyanide, was determined by titrating with a standard silver nitrate solution, with potassium iodide serving as the indicator. The author indicates that this method, though not considered very accurate, gives a sufficiently good estimation of the free cyanide baths and was chosen because it is generally used for control of plating solutions. The difference between the free cyanide content, determined by titration, and the total alkali cyanide used in each run represented the amount of combined sodium cyanide.

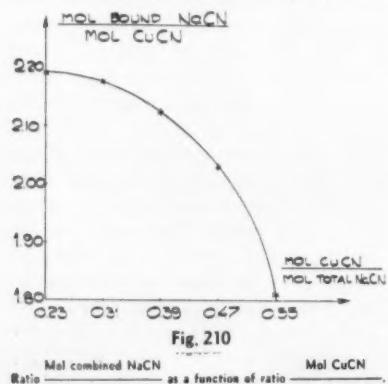


A relationship for the various concentrations of sodium cyanide representing the ratio of mol combined NaCN: mol CuCN drawn as a function of the ratio of mol total NaCN: mol CuCN (Figure 209), indicates that, with increasing content of sodium cyanide, an increase in the molecular weights of the copper cyanide (complex) ions results. The reactions for the successive increases in molecular weight may be shown accordingly by the following equations: $\text{CuCN} + \text{CN}^- \rightarrow \text{Cu}(\text{CN})_2^- + \text{CN}^- \rightarrow \text{Cu}(\text{CN})_3^- + \text{CN}^- \rightarrow \text{Cu}(\text{CN})_4^{\equiv}$. When the ratio, therefore, is 1 mol of

NaCN combined with 1 mol of CuCN (a ratio of 1), the formula for the compound would be $\text{NaCu}(\text{CN})_2$. When the ratio is 2 mols NaCN combined with 1 mol of CN (a ratio of 2), then the complex would be represented as $\text{Na}_2\text{Cu}(\text{CN})_3$; and, for a ratio of 3, the compound formed would be represented by the formula $\text{Na}_3\text{Cu}(\text{CN})_4$. An examination of the graph in Fig. 209 indicates that the ratio of mol combined NaCN:CuCN does not show the same increase as the increase in mol total NaCN:CuCN, so that, when the mol total NaCN:CuCN is as much as 4.25, the copper combined is mainly in the form $\text{Cu}(\text{CN})_3^-$ with some $\text{Cu}(\text{CN})_4^{4-}$ present. The values representing the ratio mol total NaCN: mol CuCN are obtained as follows: Using the 5 gram NaCN concentration as an

$$\begin{array}{rcccl} & 5.00 & 5.00 & & \\ \text{example, then } & \frac{\text{NaCN}}{3.00} & = & \frac{5.00}{3.00} & = 0.102 \\ & 49 & & 89.6 & \\ & & & & \\ & \frac{7.00}{49} & = & \frac{7.00}{49} & = 0.1430 \text{ mol} \\ & \text{mol total NaCN} & & \text{mol CuCN} & \\ & & & & \\ & \frac{0.1430}{0.102} & = & \frac{0.1430}{0.102} & \\ & \text{mol CuCN} & & \text{mol CuCN} & \\ & & & & 0.0334 \\ & & & & \\ & & & & = 3.05. \end{array}$$

A second series of tests was conducted with the concentration of the sodium cyanide remaining constant and the concentration of the cuprous cyanide varied. Thus 3.00, 4.00, 5.00, 6.00 and 7.00 grams of cuprous cyanide were dissolved in separate solutions, each solution having a volume of 100 ml, in which 7.00 grams of sodium cyanide were dissolved in distilled water. The temperature of the solution was 18°C. Free cyanide content was determined by titration, as in the previous tests, with silver nitrate and the combined sodium cyanide then estimated. Results are shown graphical-



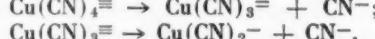
ly in Fig. 210. In this graph the ratio of mol combined NaCN: mol CuCN is drawn as a function of the ratio mol CuCN: mol total NaCN. An increase in cuprous cyanide, it was observed, will give a lower complex. Emphasis is placed, however, upon the significance of the fact that, even with an appreciable increase in CuCN, the most important ion is $\text{Cu}(\text{CN})_3^-$. The 0.31 ratio for 4 grams CuCN:7.00 grams

4

NaCN is obtained as follows:

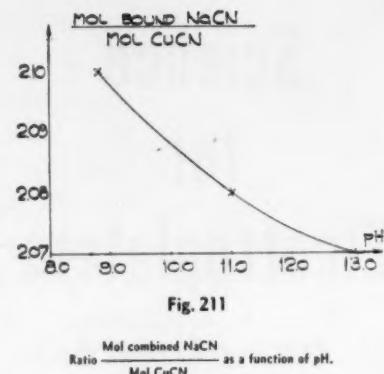
$$\begin{aligned} & \frac{4}{89.6} = 0.0446 \text{ mol}; \frac{7.00}{\text{NaCN}} = \\ & \frac{7.00}{49} = 0.1430 \text{ mol}; \frac{\text{mol CuCN}}{0.0446} = \\ & \frac{49}{0.1430} = 0.31 \end{aligned}$$

Additional experimental tests included the study of the effect of changes in pH and temperature upon the composition of the complex cuprous cyanide ions. For the pH effect, 3.00 grams of cuprous cyanide were dissolved in a solution containing 4.00 grams of sodium cyanide in 100 ml distilled water. The pH of the solution was 12.5 (18°C.). Free cyanide content was determined by titration, using the prescribed method. Additional free cyanide determinations were made with two solutions of the same composition in which the pH had been lowered to 11.1 and 8.5 respectively. The graph, Fig. 211, represents the results of these tests, wherein the ratio mol combined NaCN: mol CuCN is drawn as a function of pH of the solution. It indicates clearly a decrease in the ratio and a corresponding increase in free cyanide at higher pH. Dissociation of the complex ion with higher pH will proceed according to the following equation:



When 3.00 grams of cuprous cyanide containing 4.00 grams of sodium cyanide, and 10 ml samples titrated at temperatures of 10°, 20° and 40°C., respectively, the ratio mol combined NaCN: mol CuCN, became less with increasing temperature, and the free cyanide content showed an increase.

Increasing dilution of the cuprous cyanide solution also produced an increase in free cyanide content, with partial dissociation of the complex ion occurring, similar to results with



higher temperature and pH. For this series of tests, 6.00 grams of cuprous cyanide were dissolved in a 100 ml solution made up with 8.00 grams of sodium cyanide dissolved in distilled water. Titration of diluted samples with silver nitrate was performed as follows: a 10 ml sample was titrated directly at 18°C.; then, similarly, successive 10 ml samples were titrated after adding (diluting) 10, 20, 30 and 40 ml of distilled water respectively. The dilution factor, it is noted, must be considered in the determination of the free cyanide content. To obtain comparable results, dilution should be the same at different times.

The author concludes that most of the copper is combined as the complex ion $\text{Cu}(\text{CN})_3^-$, indicating a ratio of 1 mol cuprous cyanide to 2 mols sodium cyanide (or potassium cyanide). Accordingly, 1 gram of cuprous cyanide will require 1.10 grams sodium cyanide (1.45 grams potassium cyanide),

$$\text{CuCN (1} \times 89.6) \quad \times 1 = 1.10 \text{ grams}$$

$$2\text{NaCN (2} \times 49) \quad \text{NaCN.}$$

The following common terms relating to cyanide plating solutions are indicated and defined by M. R. Thompson. Concentrations are expressed as gram-mols per liter.

1. The *total cyanide* content is the cyanide radical (CN^-) in active form.

2. The *total alkali cyanide* is the combined alkali (sodium or potassium) cyanide.

3. The *total combined cyanide* is the amount present in active complexes.

4. The *total combined alkali cyanide* content is the alkali cyanide combined with the heavy metal (such as copper) in one or more complexes.

5. The *uncombined or free alkali cyanide* is obtained by subtracting the

TABLE I. Classification of the Complex Cyanide Anions of the Metals.

Metal		Co-ordination Number						Other Important Ion or Salt	Hydrogen Overvoltage
Symbol	Atomic Number	2 (Dicyanide)	3 (Tricyanide)	4 (Tetracyanide)	4 (Tetracyanide)	6 (Hexacyanide)	8 (Octocyanide)		
<i>Valence 1.</i>									
Cu	29	Cu(CN) ₂ ⁻	Cu(CN) ₃ ²⁻	Cu(CN) ₄ ³⁻					Moderate
Ag	47	Ag(CN) ₂ ⁻	Ag(CN) ₃ ²⁻	Ag(CN) ₄ ³⁻				TICN	
Au	79	Au(CN) ₂ ⁻							
Tl	81	Tl(CN) ₂ ⁻							
<i>Valence 2.</i>									
Cr	24				Cr(CN) ₄ ³⁻				
Mn	25		Mn(CN) ₂ ⁻		Mn(CN) ₃ ²⁻			C ₆ H ₅ O ₄ ²⁻ (Tartrate)	Low
Fe	26				Fe(CN) ₄ ³⁻			ZnO ₂ ²⁻ (Zincate)	Low
Ni	28				Ni(CN) ₄ ³⁻				High
Zn	30		Zn(CN) ₂ ⁻	Zn(CN) ₃ ²⁻					
Ru	44				Pd(CN) ₄ ³⁻	Ru(CN) ₄ ³⁻			
Pd	46							Cd(CN) ₄ ³⁻	Low
Cd	48		Cd(CN) ₂ ⁻	Cd(CN) ₃ ²⁻					High
Os	76				Pt(CN) ₄ ³⁻	Os(CN) ₄ ³⁻			
Pt	78							Hg(CN) ₄ ³⁻	Low
Hg	80		Hg(CN) ₂ ⁻	Hg(CN) ₃ ²⁻				PbO ₂ ²⁻ (Plumbite)	High
Pb	82			Pb(CN) ₄ ³⁻					
<i>Valence 3.</i>									
V	23					V(CN) ₄ ³⁻			
Co*	27					Co(CN) ₄ ³⁻			
Rh	45					Rh(CN) ₄ ³⁻			
In	49			In(CN) ₄ ⁻				C ₆ H ₁₁ O ₆ ²⁻ (Glucosate); or C ₆ H ₅ O ₄ ²⁻ (Tartrate)	
Ir	77						Ir(CN) ₄ ³⁻		
<i>Valence 4.</i>									
Mo	42						Mo(CN) ₄ ³⁻		
W	74						W(CN) ₄ ³⁻		

* The cobaltcyanide ion Co(CN)₄³⁻ is said by Williams [“The Chemistry of Cyanogen Compounds,” p. 44, J. and A. Churchill, London (1915)] to be very unstable and to oxidize rapidly to cobaltcyanide ion Co(CN)₅²⁻. A cobaltcyanide ion Co(CN)₅²⁻ has been detected electrometrically by Glasstone and Speakman [Analyst 55, 93 (1930)], and others.

total combined alkali cyanide from the total alkali cyanide, commonly determined by titration. W. Blum defines this term as the difference between the total alkali cyanide and the amount of alkali cyanide necessary to keep the metallic compounds in solution.

6. The *metal cyanide* content is computed from the heavy metal present.

7. The *cyanide ratio* relates to the mol ratio of the total alkali cyanide (dissolving substance, as NaCN) to the metal cyanide (usually insoluble in water as CuCN), or

$$\frac{\text{total alkali cyanide}}{\text{metal cyanide}}$$

$$= \frac{\text{total alkali cyanide}}{\text{metal cyanide}}$$

The following example, given by M. R. Thompson, illustrates the terms introduced: A solution consisting of 1 M (mol) Na₂Zn(CN)₄ and 1 M NaCN would represent the following values: total cyanide = 5 M; total alkali cyanide = 3 M (2 M combined + 1 M free NaCN); total combined alkali cyanide = 2 M; uncombined or free alkali cyanide = 1 M; metal cyanide =

$$= 3 \text{ M NaCN}$$

$$\text{1 M; cyanide ratio} = \frac{3 \text{ M NaCN}}{1 \text{ M Zn(CN)}_4}$$

Deposition Mechanism

A number of theories have been advanced to explain the metal deposition process from complex cyanide plating solutions. One proposal considers the deposition first of the alkali (sodium or potassium) ion, which in turn is replaced, a secondary process, by deposition of the heavy metal. Thus, for a silver cyanide solution, the reactions at the cathode are assumed to proceed as follows: $\text{Na}^+ + e \rightarrow \text{Na}^\circ$; $\text{Ag}(\text{CN})_2^- \rightleftharpoons \text{Ag}^+ + 2\text{CN}^-$; $\text{Na}^\circ + \text{Ag}^+ \rightarrow \text{Na}^+ + \text{Ag}^\circ$.

The existence of the silver ions, in small concentrations of the order of about 10^{-18} g/l, is indicated in the reversible equation for the silver cyanide complex, has been demonstrated, S. Glasstone notes, by the precipitation of silver sulfide when hydrogen sulfide is added to a silver cyanide solution.

A second proposal considers the direct deposition of the simple metal ion, such as Ag⁺, resulting from dissociations of the metal cyanide complex, with small ion concentration favoring crystal nucleus formation. The extremely low metal ion concentration, with the migration velocity necessary for continued metal deposition, is the questionable phase of this proposal.

A third consideration suggested by S. Glasstone to account for the fine grained deposit includes deposition of the complex cation, such as Ag₂(CN)⁺, caused by dissociation of the anion: $2\text{Ag}(\text{CN})_2^- \rightleftharpoons \text{Ag}_2(\text{CN})^+ + 3\text{CN}^-$. This complex cation then splits up further to yield silver, which is deposited, and silver cyanide: $\text{Ag}_2(\text{CN})^+ + e \rightarrow \text{Ag}^\circ + \text{AgCN}$.

A fourth suggestion indicates direct deposition from the complex anion Ag(CN)₂⁻, wherein an additional charge is acquired, followed by rapid decomposition to yield silver and cyanide ion: $\text{Ag}(\text{CN})_2^- + e \rightarrow \text{Ag}^\circ + 2\text{CN}^-$. C. Kasper showed experimentally that deposition of chromium from the chromic acid bath occurs directly from anions.

Properties of Cyanide Baths

A comprehensive classification of complex cyanide anions of heavy metals, compiled by M. R. Thompson, with the metals arranged in order of the common valence and atomic number, is shown in Table I. Complexes to the left of the heavy line, it is indicated, based upon available data, represent compounds from which metals are readily deposited, while those on the

Luster-on

ECONOMICAL PROTECTIVE
COATINGS FOR BRASS,
ZINC, CADMIUM, COPPER,
ALUMINUM

The Chemical Corporation offers a complete line of uniform-controlled chromate conversion coatings that provide maximum protection in one, low-cost, simple operation. Available for immediate delivery as liquid or powder.

Always Specify Luster-on —

FOR BRILLIANT CORROSION-RESISTANT FINISHES . . .

rivaling chrome for many applications where cost is a factor. Long-lasting, easily controlled application.

FOR CLEAR, BRIGHT and IRIDESCENT COATINGS . . . gives striking, attractive appearance with complete corrosion-protection... even when humidity and handling are involved during processing. Also yellow iridescent and olive drab for concealed parts or as a paint bond.

FOR DECORATIVE COLOR . . . on low-cost zinc. Brilliant golds, yellows, blues, greens, violets, reds, brass and copper hues.

FOR ALUMINUM . . . where surface hardness is not of prime importance. Excellent finish for paint bonding.

FOR LASTING BRIGHTNESS . . . on both copper and brass without noxious fuming.

FOR DIE-CASTINGS . . . one quick dip provides uniform finish, ideal as a base for painting.

We'd like to show you what Luster-on can offer you! Send in sample part today for free processing. Data sheets on request.

Luster-on . . . the first and still the finest in conversion coatings.

The

**Chemical
Corporation**

58 Waltham Ave., Springfield 9, Mass.

TABLE 2
Probable Complex Ions Present in Cyanide Plating Baths

Bath	Major Complex Ions	Minor Complex Ions
Copper	$\text{Cu}(\text{CN})_5^-$	$\text{Cu}(\text{CN})_2^-$, $\text{Cu}(\text{CN})_4^-$
Silver	$\text{Ag}(\text{CN})_2^-$	
Gold	$\text{Au}(\text{CN})_2^-$	
Zinc	$\text{Zn}(\text{CN})_4^-$, ZnO_2^-	$\text{Zn}(\text{CN})_3^-$
Cadmium	$\text{Cd}(\text{CN})_4^-$	$\text{Cd}(\text{CN})_2^*$, $\text{Cd}(\text{CN})_3^-$
Brass	$\text{Cu}(\text{CN})_5^-$, $\text{Zn}(\text{CN})_3^-$	$\text{Cu}(\text{CN})_2^-$, $\text{Cu}(\text{CN})_4^-$, $\text{Zn}(\text{CN})_3^-$

*Cd cyanide which may be slightly ionized.

right of the heavy line will deposit with difficulty or not at all. Ready deposition is an arbitrarily chosen term applied to cathode current efficiency of 90 per cent or higher; difficult deposition applies to a cathode current efficiency of less than 90 per cent. Additional anions that have been found to improve deposition (mixed baths) are included in the table. The term coordination number refers to the complex cyanide anion, wherein a central positive heavy metal ion, such as copper, combines and is surrounded by a number of the negative or cyanide ions. The number of such ions attached by covalent linkage to the central atom is known as the coordination number. This number is usually 4 or 6, with others occurring less frequently, and compares with the negative charge on the anion.

The significant properties of cyanide plating baths, some of which are indicated in the table, are as follows: metals depositing readily from cyanide solutions are found in groups 1 and 2 of the periodic chart (Cu, Ag, Au, Zn, Cd), while those from group 8 (Fe, Ni, Rh, Pt) deposit with difficulty; an increase in metal concentration will tend toward a lowering of the coordination number and aid deposition; an increase in alkali cyanide will result in a corresponding increase of the cyanide ratio, a higher coordination number, and a decrease in the metal cyanide concentration.

G. M. Smith and J. M. Breckenridge found that the increase in alkali cyanide in the copper cyanide solution resulted in a decrease in cathode efficiency and a higher cathode polarization, with increase in current density. For example, with a molal ratio of copper to sodium cyanide of 1 to 2, a current density of 1.19 amp./ft.², the cathode current efficiency is 85.2 per

cent; whereas, with a current density of 5.76 amp./ft.², the current efficiency is reduced to 71.3 per cent. When the molal ratio of copper to sodium cyanide was 1 to 4, a current density of 4.80 amp./ft.² resulted in a current efficiency of only 4.87 per cent; and, when the molal ratio of copper to sodium cyanide was increased to 1 to 6, the cathode actually lost weight. This was attributed to the dissolution of the cathode in the electrolyte occurring more rapidly than copper deposition for the current densities studied. Dilution has a similar effect.

Anode efficiency increased with an increase in free cyanide and a decrease in current density. The author concludes that cathode efficiency decreases with increase in current density, dilution, and decrease of molar ratio of copper to sodium cyanide; anode efficiency increases with decrease in molar ratio of copper to sodium cyanide, and decreases with increased current density.

S. Glasstone found that, with an appreciable excess of sodium cyanide in the solution (0.9 N sodium cyanide), in addition to the 0.1 N sodium argentocyanide solution, $\text{NaAg}(\text{CN})_2$, little variation in cathode potential occurs from current densities below 0.0025 amp./cm.², and cathode efficiency showed little change with increase in cyanide ratio.

A summary of the probable constitution of complex ions presents in common cyanide plating baths, at room temperature, presented by M. R. Thompson, is shown in Table 2. Since the usual control methods of determining free cyanide in cyanide plating baths, the author notes, is usually done by titration, a method considered accurate for silver but not for copper, brass, or cadmium, the table, it is suggested, may require revision at times.

SHOP PROBLEMS

BARREL FINISHING — POLISHING AND BUFFING
CLEANING — ANODIZING — ELECTROPLATING
RUSTPROOFING — LACQUERING AND ENAMELING



METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Electroless Nickel

Question: Will you please explain why deposits from the "electroless" or catalytic nickel baths should contain a significant amount of phosphorus. It seems to me that the reduction of the nickel salt with hypophosphite should result in precipitation of metallic nickel only, with evolution of hydrogen. Can you refer me to any source of information as to the chemical reaction of the process?

L. D. M.

Answer: It has been postulated that the reaction proceeds in three stages, as follows:

1. $\text{PO}_2\text{H}_2^- \rightarrow \text{PO}_2^- + 2\text{H}$
(decomposition)
2. $\text{PO}_2^- + \text{H}_2\text{O} \rightarrow \text{PO}_3\text{H}_2^-$
(hydrolysis)
3. $\text{Ni}^{++} + 2\text{H} \rightarrow \text{Ni} + 2\text{H}^+$
(reduction)

According to this theory, the atomic hydrogen is able to reduce either hypophosphorous or phosphorous ions to phosphide, which explains why the coatings contain 6-8% phosphorus from the acid bath.

Holloware Standards

Question: Our firm has been requested to quote on silver plated holloware to meet the following specifications: Federated Specification Plate; Extra Heavy Hotel Plate; and Heavy, Medium and Light Plate.

We are familiar with the first specification, which calls for 20 dwt. silver per square foot of surface, but can obtain no information as to the others. Since we must enter our bids in the very near future, we are calling on you for assistance, as the foremost authority on plating, and will be awaiting your early reply.

R. P.

Answer: There are no legal requirements for any of the above designations, but the following amounts of silver are generally accepted:

Extra Heavy Hotel	
Plate	15 dwt./sq. ft.
Heavy Plate	10 "
Medium Plate	5 "
Light Plate	2 "

Waste Treatment

Question: We have recently discontinued using cyanide brass and copper plating solutions (approximately 400 gallons), and we have crystallized same for easier handling. We would like to know if there is any company who purchases these crystals, or what would you recommend as a safe manner of disposal.

S. S.

Answer: We know of no companies who purchase brass and copper cyanide solutions. Chlorination would not be practicable unless you have proper facilities available. However, the solutions can be decomposed by plating at high temperature with steel anodes, after adjusting the pH to at least 8.5, at a voltage of about 5-7. Cyanide can be reduced to a few parts per million and the metals deposited on steel sheets.

Porosity Test for Anodized Aluminum

Question: Is there a porosity test, similar to the "Ferroxyl" test for nickel plated steel, which can be used for anodized aluminum? We wish to use this test to locate discontinuities in the oxide film.

J. R. N.

Answer: Two test solutions have appeared in the literature. One consists of 20 g/l sodium chloride and 1

g/l cupric nitrate, in which anodized aluminum is immersed at room temperature. Copper will deposit in the pores in 5 to 30 minutes.

The other test employs the following stock solution:

Cupric nitrate	10 g.
Sodium chloride	200 g.
Water	1 l.

10 cc. of the stock solution are diluted to one liter with water. Upon immersion of the part, dark spots appear at points of failure. It should be noted that this test solution is the same as the first, except that it is only one-tenth as concentrated in final form.

Purification of Nickel Bath

Question: For the past several years we have been avid readers of METAL FINISHING and at the present we would like to take advantage of your Shop Problems column.

The problem is this. Do you have any data on dummies for removing impurities from nickel plating solutions used in plating plastics for electrotypes? What is the correct current to use for this operation? We use an agitated single nickel salt solution with the following:

Ammonium chloride	3/4 oz./gal.
Temperature	90°
Current	5 volts
pH	6.2

Any information you might be able to furnish us would be greatly appreciated.

A. C. V. B.

Answer: The pH of the solution should be brought down to about 4.5 with sulfuric acid, then the bath dummed at about 1.5-1.75 volts, preferably using corrugated sheets of steel (3" corrugations) and agitation, although good results will also be obtained on flat sheets.

Since you are working with plastics, there is a possibility of organic contamination, for which dummying is not an effective purification method. If the solution still shows signs of contamination after dummying for at least 16 hours, we would suggest treatment with

4 lbs. of activated carbon per 100 gallons of solution.

Blisters on Plated Zinc Castings

Question: The piece that is being sent by separate package is marked for the blistering problems which we have with the part. After this piece was plated, it was painted and baked at 275°-300° F. for 30 minutes. The paint did not have good adhesion, so it was stripped, showing up the blisters.

If you have any solution for this condition, I would appreciate hearing from you as soon as possible.

F. J. K.

Answer: Blistering of this type is usually due to a skin on the surface of the casting, which is not removed completely in the cleaning and acid dip operations. It may also be due to a "cold shut" in the casting, which will be evident upon examination of the raw metal surface.

We would suggest that you call in your cleaning compound supplier, if the former is the cause of the trouble.

Blackening Powdered Iron Compacts

Question: We are blackening powdered iron parts and are troubled with leaching out of white powder after rinsing and drying. Is there any way of eliminating this salt formation without affecting the black finish?

H. R. D.

Answer: Powder compacts, being porous, have a tendency to spot out badly. Many manufacturers of blackening salts offer materials to minimize the condition. For best results, however, ultrasonic treatment in clean water or alcohol is suggested.

Plating Over Passive Nickel

Question: In our plating process we have some parts that come from the Watts type nickel plating solution and are stored for a few hours in distilled water. We then use an eight ounce sulfuric acid to one gallon of water dip. This is followed by a cold water rinse before the parts are hard chrome plated. We are experiencing difficulty in that some of the hard chrome plate is peeling. We are of the opinion that the difficulty is in the cleaning.

Would you please recommend a more reliable cleaning method between the nickel and hard chrome plating operations?

H. B. M.

Answer: Chromium will not adhere well to passive nickel. If it is necessary to store the nickel plated work, it should be reactivated prior to chromium plating.

An effective method of activation is

to plate for about 1-3 minutes at 6 volts and room temperature in a solution of 2 lbs./gal. nickel chloride and 1 pint/gal. muriatic acid. Nickel or carbon anodes may be used in this strike solution.

Professional Directory

A. L. PIETROWICZ

SCIENTIFIC / CHEMICALS
OF CALIFORNIA
CONSULTANTS IN ELECTROPLATING,
HARDENING AND METAL PROCESSING

1700 E. Gage Ave. Los Angeles 1, Calif.
LUDlow 2-3794

DO YOU HAVE ANY PROBLEMS IN:

barrel-still-automatic PLATING?
sulfuric-chromic-color ANODIZING?
personnel training-process EFFICIENCY?
chemical-metallurgical-salt spray TESTING?
THEN call our chemists-engineers-CONSULTANTS

INDUSTRIAL ELECTROPLATING
LABORATORIES
19 Garwood Road Fair Lawn, N. J.
SWarthmore 6-1699

AARON ENGLANDER

METAL FINISHING CONSULTANT
Plating solutions—analysis and control.
Specialist on Polishing and Lacquering
Problems.
Engineering of Metal Finishing Installations.
3260 Netherlands Ave., Bronx 63, N.Y.
Kingsbridge 3-7087

GRAHAM, SAVAGE & ASSOCIATES, INC.

CONSULTING - ENGINEERING - RESEARCH
Electroplating and Metal Processing
Waste Treatment and Production Problems
SURVEYS - DESIGNS - SPECIFICATIONS
475 York Rd. Jenkintown, Pa.
1724 Clinton St. Kalamazoo, Mich.

SCIENTIFIC CONTROL LABORATORIES

Finishing Consultants—Registered Engineers
Salt Spray—Thickness Testing—Analyses
PLANNING—RESEARCH—DEVELOPMENT
CLIFFSIDE 4-2406
3136 S. Kolin Avenue, Chicago 23, Ill.

G. B. HOGABOOM JR. & CO.

Consulting Chemical Engineers
Metal Finishing — Electrodeposition — Solution analyses. AIR FORCE CERTIFICATION TESTS — Salt Spray, thickness of deposits, adhesion.
44 East Kinney St. Newark 2, N. J.
MARKET 3-0055

HENRY LEVINE & SON, Inc.

Metal Finishing Consultants
Analysis of all electroplating solutions
Engineering of finishing installations
Air Force Certification Tests
Salt Spray Thickness and Adhesion Tests
153 East 26th St., New York, N.Y.
MURRAY HILL 5-9427

THE AMACHEM LABORATORIES

TESTING ANALYSES ENGINEERING
For Metal Finishers
Plating solution analyses and control. Testing of deposit-thickness, composition, porosity, tensile strength. Salt Spray tests.
AIR FORCE CERTIFICATION TESTS
1724 West 58th St., Los Angeles 62, Calif.
AXminster 4-1262

PAUL R. DUKES

REGISTERED ENGINEER
Consulting services on production finishing problems, equipment design.
Services include design layout, hanger design, methods of costing, testing parts, methods of finishing.
INDUSTRIAL FINISHERS, INC.
2284 Albion St. Toledo 6, Ohio
Cherry 8-3391

ERNEST J. HINTERLEITNER

5117 Crenshaw Boulevard
LOS ANGELES 43, CALIFORNIA
AXminster 4-1531

research — engineering — consulting
since 1926 . . . U.S.A. and Foreign

CROBAUGH LABORATORIES

TESTING - RESEARCH - ENGINEERING
Chemical - Metallurgical - X-Ray
Spectrographic - Organic
Metal Finishing Problems
Air Force Certification Tests
THE FRANK L. CROBAUGH CO.
3800 Perkins Cleveland 14, Ohio

PLATERS

TECHNICAL SERVICE, Inc.

ELECTROPLATING AND CHEMICAL ENGINEERS

- Air Force certification tests
- Salt Spray, thickness and adhesion tests
- Spectrographic analysis
- Solution, Metal and Salt analysis
- Plant Design and Engineering
- Plant layout and construction
- Industrial waste and water supply treatment

59 East 4 St., New York 3

ALgonquin 4-7940

509 S. Wabash Ave.,

Chicago 5

HArrison 7-7648

TOMORROW'S PRODUCTS TESTED TODAY

A service to aid industry in producing longer-lasting and better-looking products. Quick predetermination of durability and permanency by actual exposure test in South Florida. Write us today for full information.

SOUTH FLORIDA TEST SERVICE, INC.
EST. 1931
4301 N. W. 7th St. Miami 44, Fla.



Patents

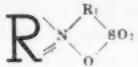
RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD

PRINTED COPIES OF PATENTS are furnished by the Patent Office at 25 cents each. Address orders to the Commissioner of Patents, Washington 25, D. C.

Ductile Nickel Deposits

*U. S. Patent 2,876,177. Mar. 3, 1959.
W. Gundel and W. Strauss, assignors to Dehydag, Deutsche Hydrierwerke G.m.b.H.*

An acid Watts-type nickel electroplating bath having dissolved therein a heterocyclic compound having the general structural formula selected from the group consisting of



and



wherein



is a heterocyclic radical, R being a cyclic radical with 0 to 1 ring nitrogen atoms, the remainder being carbon atoms, and R₁ is selected from the group consisting of lower aliphatic, cycloaliphatic and aromatic radicals, and Me is an alkali metal atom, said compound being present in an amount sufficient to produce smooth and ductile nickel electrodeposits.

Bright Copper

*U. S. Patent 2,876,178. Mar. 3, 1959.
E. H. McCoy*

In a process for electrodepositing copper from a copper cyanide solution, the step of adding at least .001 g./l. of a metal selected from the group consisting of cobalt and nickel, and at least .05 g./l. of a compound selected from the group consisting of 2,4-lutidine and 2,6-lutidine.

Electrostatic Coating

*U. S. Patent 2,877,137. Mar. 10, 1959.
R. C. Juvinal and A. W. Von Fange, assignors to Ransburg Electro-Coating Corp.*

The method of electrostatically coating an article which comprises supplying liquid coating material to an annular atomizing zone, moving the ar-

ticles to be coated along a predetermined path through a coating zone spaced from said atomizing zone and electrostatically charging the atomizing zone to form a depositing electrostatic field having lines of force extending between the atomizing zone and an article in said coating zone.

Organic Coating Material

*U. S. Patent 2,877,197. Mar. 10, 1959.
E. E. Fisher, assignor to E. I. du Pont de Nemours & Co.*

A liquid coating composition comprising a solution in a volatile organic solvent of (1) a polythiol polymer having at least three reactive thiol groups per molecule, the number of said thiol groups present being in the range of about 0.025-0.5 per carbon atom in the polymer chain of the molecule, (2) a metallic drier compound in an amount corresponding to 0.005%-2.0% of metal based on the weight of said polymer, and (3) 0.1%-5.0%, based on the weight of said polymer, and (3) 0.1%-5.0%, based on the weight of said polymer, of a basic amino nitrogen compound having 1-5 amino nitrogen atoms and 2-20 carbon atoms per molecule.

Pickling Waste Recovery

*U. S. Patent 2,877,146. Mar. 10, 1959.
C. B. Francis, assignor to Puriron Chemicals, Inc.*

Pickling a ferrous article by passing it sequentially through a series of pickling baths of hot dilute sulfuric acid solution wherein there is a movement of such solution from bath to bath in a direction counter to the movement of said article and an accumulation of dissolved ferrous sulfate to form pickle liquor of progressively greater ferrous sulfate concentration along the series of baths, withdrawing heated pickle liquor from a point adjacent to the work-entering end of the series and forming the withdrawn liquor into a plurality of batches,

evaporating a substantial portion of the contained water from said batches severally while the heated liquor is below the temperature at which sulfuric acid is evolved and effecting a precipitation of suspended ferrous sulfate in the resulting concentrate, recovering by gravity separation the precipitated ferrous sulfate, recovering supernatant liquid in the form of a sulfuric acid solution including a residual quantity of dissolved ferrous sulfate, returning the recovered sulfuric acid solution to the series of baths at a point removed from the work-entering end thereof, adding new sulfuric acid at a point more removed from the entering end of the series than the point at which the recovered acid is added, and adding water to the series of baths, as required.

Resin Gun

*U. S. Patent 2,878,063. Mar. 17, 1959.
S. P. Kish, J. W. Donnell and D. M. Graves, assignors to Kish Industries, Inc.*

A resin spray gun comprising separate resin and catalyst conduits, a nozzle, means defining a chamber between and communicating with said conduits and said nozzle, and a baffle within said chamber, said baffle comprising a wire brush having radially extending bristles contacting the peripheral wall of said chamber.

Reciprocating Spraying Apparatus

*U. S. Patent 2,878,058. Mar. 17, 1959.
W. D. Gauthier and H. A. Williams, assignors to Ransburg Electro-Coating Corp.*

An electrostatic spray coating system having a hydraulically actuated reciprocator including a piston and cylinder device having a rod connected to the piston for reciprocating an electrically charged spraying device.

Tinting Bases for Both Oil and Water Reducible Paints

*U. S. Patent 2,878,135. Mar. 17, 1959.
V. M. Willis, assignor to The Sherwin-Williams Co.*

A tinting base for use in decorative coatings which comprises in combination from 35% to 60% by weight of a water insoluble pigment, from 5 to 30% by weight of a nonionic surface active agent selected from the class consisting of alkyl polyoxyalkylene ethanols and alkyl phenoxy polyoxyalkylene ethanols, and from 15 to 50% by weight of a coupling alcohol se-

lected from the group consisting of hexylene glycol and 3-methoxy butanol.

Automatic Painting, Wiping, and Polishing Machine

*U. S. Patent 2,878,139. Mar. 17, 1959.
R. B. Way and C. D. Hersey*

A process of painting and polishing articles of manufacture comprising depositing a predetermined amount of paint on an article, allowing said article to dry a predetermined time, bringing said article into engagement with a strip of polishing material, moving said article into engagement with said material whereby excess paint is removed from said article, allowing said article to dry a predetermined time whereby said residual paint not removed by wiping is allowed to dry, bringing said article into engagement with another said material, and moving said article relative thereto whereby said residual paint is removed from said article and said article is polished.

Blackening Copper Alloys

*U. S. Patent 2,878,149. Mar. 17, 1959.
W. A. Mason*

A solution batch consisting of in proportion approximately 3 to 12 pounds of a copper blackening agent selected from the group consisting of oxygen acids and salts of selenium and tellurium, a copper salt in an amount by weight approximately equal plus or minus 15% to the weight of copper blackening agent, approximately 2 to 6 pounds of arsenic trioxide, approximately 110 to 170 fluid ounces of hydrochloric acid, approximately 2 to 4 pounds of alkylaryl sulfate, approximately 5 to 20 gallons of an alcohol, and approximately 22 to 54 gallons of water.

Method of Applying Pigmented Coating to Sheet Metal

*U. S. Patent 2,878,141. Mar. 17, 1959.
T. L. Canniff, assignor to American Can Co.*

The method of coating a metal sheet to protect the same and to produce a lustrous finish thereon, comprising applying a fluid base coating to said sheet and thereafter applying a fluid top coating while said base coating is wet, said coatings containing compatible film-forming resins and compatible solvents to form adherent unbroken coating layers, said top coating further containing a pigment comprising metallic leaflets, said leaflets and

said top coat resin having substantially equal parts by weight, said base coat having a weight per unit area and a viscosity each at least twice that of said top coat to produce a tough protective coating on said sheet and to permit said base coat solvent to evaporate through said less viscous top coat without disturbing said pigment therein, whereby to produce a lustrous grainless finish on said sheet, and evaporating said solvents and curing said resins.

Electrostatic Coating Method

*U. S. Patent 2,878,143. Mar. 17, 1959.
R. C. Juvinal, assignor to Ransburg Electro-Coating Corp.*

A method of electrostatically coating a plurality of articles from exteriorly thereof, comprising projecting spray particles from a source radically in a pattern expanding generally in a single plane, carrying articles to be coated in a path extending a substantial distance around said source, said path being inclined to the horizontal and to the plane of the spray pattern and having a configuration to produce vertical movement of the articles through said pattern at a substantially constant rate, and creating an electrostatic charge differential between the spray particles and the articles electrostatically to deposit the particles on the articles.

Acid Pickling

*U. S. Patent 2,878,146. Mar. 17, 1959.
A. J. Certa, assignor to Philco Corp.*

The method of removing oxide from the surface of oxidized iron and steel articles and concurrently conditioning said surface to resist reoxidation, which comprises immersing the oxidized article in a bath consisting essentially of a solution of ammonium chloride in aqueous hydrochloric acid at a temperature between about 40° C. and the boiling point of said bath, said aqueous hydrochloric acid containing between about 16 and about 37%, by weight, of HCl and said ammonium chloride being present in an amount between about 10 grams per 100 ml. of aqueous hydrochloric acid and a mass sufficient to saturate said aqueous hydrochloric acid at said temperature.

Abrasive-Bearing Electrodeposits

*U. S. Patent 2,878,171. Mar. 17, 1959.
M. Ferrand*

The method of producing abrasive tools in the form of a continuous belt

of bonding metal containing layers of even thickness of abrasive particles, including the steps of depositing successive layers of abrasive particles on a moving endless belt carrier in a cyclical process, and simultaneously and continuously depositing bonding metal on the carrier by electrodeposition at a rate such that particles of abrasive material deposited on the carrier become completely enclosed by bonding metal before the next succeeding deposition of abrasive particles on that portion of the belt occurs.

Silver Plating Stainless Steel

*U. S. Patent 2,878,172. Mar. 17, 1959.
A. C. Scavullo, assignor to V. K. Scavullo, C. Scavullo, F. Scavullo, M. S. Saegert and M. S. Scott*

In the production of silver-plated stainless steel ware, the art which comprises fashioning the ware of chromium-nickel stainless steel having a nickel content of at least about 2%; then subjecting the ware in sequence to a nickel strike at a current density ranging from about 60 to 80 amperes per square foot enduring for approximately one minute; then copper-striking the base article for a period of about 30 seconds in a copper cyanide solution at a current density of about 30 amperes per square foot; then silver-striking the article in a silver cyanide bath for about 30 to 60 seconds at a current density of approximately 30 amperes per square foot; then wire brushing the article; finally plating the article thus treated for approximately one-hour in a silver cyanide bath at a current density of about 8 to 10 amperes per square foot, until a silver deposit is achieved ranging in thickness from 0.0025 inch to about 0.0030 inch; and polishing the plated article.

Pickling Cobalt-Nickel-Iron Alloys

*U. S. Patent 2,878,189. Mar. 17, 1959.
A. J. Certa, assignor to Philco Corp.*

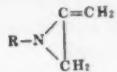
The method of removing oxide from the surface of an oxidized cobalt-nickel-iron alloy article without attack on the metal itself which comprises immersing the oxidized article in a bath, at a temperature above about 50° C., consisting essentially of ammonium sulfate in aqueous sulfuric acid, at least until oxide has been removed from said surface, the concentration of sulfuric acid in the water being between about 15 and about 30%, by volume, calculated as 66° Bé.

H_2SO_4 , and said ammonium sulfate being present in an amount of at least about 75 grams per 100 ml. of aqueous sulfuric acid.

Stabilization of Chlorinated Solvents with Aziridines

*U. S. Patent 2,878,297. Mar. 17, 1959.
E. J. Watson and D. E. Rapp, assignors
to The Dow Chemical Co.*

A stabilized chlorinated aliphatic hydrocarbon solvent composition comprising from 50 to 5000 parts by weight of an aziridine compound hav-



ing the formula wherein R is an aliphatic hydrocarbon radical having from 1 to 4 carbon atoms, inclusive, per million parts of solvent.

Electroformed Sheets

*U. S. Patent 2,878,553. Mar. 24, 1959.
H. C. Hirsch*

A rigidized electrolytically deposited metal sheet deformed from an initial planar shape.

Abrasive Blasting Head

*U. S. Patent 2,878,624. Mar. 24, 1959.
H. Hastrup and R. C. Hastrup*

In an abrasive blast cleaning machine, an operating head provided with a channel through which a blast stream is directed toward a work surface and a channel through which a suction stream draws spent abrasive and debris away from said surface.

Paint Mixing Tool

*U. S. Patent 2,879,044. Mar. 24, 1959.
P. J. Gunas*

A tool for mixing paints and the like.

Metalizing Non Conductors

*U. S. Patent 2,879,175. Mar. 24, 1959.
E. J. Umbria and E. A. L. Schulze,
assignors to Telefonaktiebolaget L. M.
Ericsson*

A method of coating a non-metallic surface with a film of metallic silver which comprises: activating said surface first with a solution containing divalent tin ions and secondly with a solution containing silver ions; followed by exposing the thus-activated surface to a silvering solution containing a complex silver compound wherein the concentration of the silver ions does not exceed 10^{-6} gramions/l., hydroxyl ions in a concentration that

does not exceed 10^{-3} gramions/l., a reducing agent active only in alkaline solution; and then adding to the said silvering solution an alkaline substance to increase the hydroxyl ion concentration in the silvering solution to exceed 10^{-3} gramions/l.

Organic Coating Application

*U. S. Patent 2,879,180. Mar. 24, 1959.
G. J. Page and J. Harrison, assignors
to The Spra-Con Co.*

In the method of treating surfaces of an article with a liquid composition comprising the steps of mounting the article in position whereby it is relatively free of pockets which might prevent drainage of excess liquid from the surfaces thereof, advancing the article rectilinearly, reciprocating a liquid effusor about a path curvilinear in at least portions thereof and substantially perpendicular to the direction of movement of the article and offset from the path thereof but facing towards the article during movement, feeding the liquid composition in a continuous solid stream under pressure to the effusor whereby the liquid composition is ejected as a solid stream and is thrown by the combination of said pressure and centrifugal force onto the surfaces of the article as it passes by, and balancing the rate of movement of the article and the volume of liquid thrown from the effusor to deposit liquid composition onto the surfaces of the article in amount sufficient to cause drainage from said surfaces.

Descaling Zirconium

*U. S. Patent 2,879,186. Mar. 24, 1959.
W. Fischer, assignor to Aktiengesellschaft
fur Unternehmungen der Eisen-
und Stahlindustrie*

A process for cleaning zirconium metal surfaces by removing scale layers therefrom, comprising the steps of preparing a molten bath of an alkali metal hydrogen fluoride salt and dipping therein the surface to be cleaned.

Electroforming

*U. S. Patent 2,879,209. Mar. 24, 1959.
S. Fialkoff, assignor to Camin Labora-
tories, Inc.*

A process for forming a hollow body adapted to serve as a cavity for the molding of replicas of an object to be reproduced, comprising the steps of preparing a mandrel conforming to the desired object, electroforming a

complementary metallic shell of limited wall thickness around said mandrel, removing the shell and filling the shell with water, immersing the so filled shell in an electrolytic solution, and cathodically depositing additional metal from said solution on the outer surface of said shell until the wall thickness of the latter has been at least doubled.

Plating on Aluminum

*U. S. Patent 2,879,210. Mar. 24, 1959.
A. M. Howard, assignor to Steel Pro-
tection and Chemical Co., Inc.*

In a continuous process of preparing elongated aluminum in wire or strip form preliminary to a final plating, the steps comprising cleaning the aluminum to obtain a substantially chemically pure surface thereon; continuously passing the aluminum as a cathode through a first aqueous alkaline solution consisting essentially of lead and zinc ions in the ratio of from 0.4 to 2.0 grams of lead to 5 to 15 grams of zinc per liter, a chelating compound, and sodium cyanide in the presence of a carbon anode while passing an electric current between the cathode and the anode, producing a lead-zinc strike directly on the aluminum; and continuing the travel of the aluminum directly from said solution immediately into and continuously through, while connected with said current is a cathode, a second solution containing copper cyanide to receive a copper strike over said lead-zinc strike in the presence of a copper anode while passing an electric current between the cathode and the anode; the dwell period of the aluminum in said first solution ranging from approximately five to ten seconds, and providing a lead-zinc strike limited to from two to three millionths of an inch.

Duplex Nickel Plating

*U. S. Patent 2,879,211. Mar. 24, 1959.
O. Kardos and P. Neumann, assignors
to Hanson-Van Winkle-Munning Co.*

The method of producing a nickel electroplate of duplex structure having enhanced capability of protecting underlying metal from corrosion which comprises establishing a substantially unagitated aqueous nickel electroplating bath in which a brightening addition agent is incorporated, introducing an article to be electroplated into the unagitated bath, said bath being substantially quiescent in the vicinity of said article, and electrodepositing

nickel of a generally columnar, fibrous microstructure until a substantial nickel electroplate has formed on the article, and thereafter, without withdrawing said article from the bath and without discontinuing the deposition of nickel thereon, subjecting said bath in the vicinity of the article to vigorous agitation until a further substantial amount of nickel of a lamellar microstructure has been electroplated on said article.

Organic Coating

*U. S. Patent 2,879,246. Mar. 24, 1959.
J. Jackson, assignor to E. I. du Pont
de Nemours and Co.*

A coating composition comprising a major amount of an organic film-forming material and a minor amount of a chromic hydroxide/ferric hydroxide pigment in which the mol ratio of chromic hydroxide to ferric hydroxide ranges from 70:30 to 95:5.

Continuous Vacuum Coating

*U. S. Patent 2,879,739. Mar. 31, 1959.
W. F. Bugbee and R. M. Boehme, as-
signors to National Research Corp.*

A coating apparatus for the continuous coating of a substrate with metal.

Spray Gun

*U. S. Patent 2,879,947. Mar. 31, 1959.
J. F. Siefen*

A spray gun of the class described.

Gas Plating

*U. S. Patent 2,880,115. Mar. 31, 1959.
F. E. Drummond, assignor to The
Commonwealth Engineering Co. of
Ohio*

A method of gas plating light metal selected from the group consisting of aluminum and magnesium on the surface of an article, which comprises heating said article in an inert atmosphere, and contacting said heated article with a gaseous heat-decomposable compound selected from the group consisting of alkyl and aryl compounds of said light metals, said article being heated to a temperature to cause thermal decomposition of said compound and deposition of the light constituent onto the surface of the article.

Iron Electroforming

*U. S. Patent 2,880,147. Mar. 31, 1959.
G. L. Cunningham, assignor to Hor-
izons Inc.*

A process for electrodepositing a

ferrous metal from an aqueous electrolyte which includes coating a metal cathode with a composition to facilitate the separation of the metal electrodeposit from said cathode, said composition consisting essentially of: finely divided graphite, ethyl cellulose and a compatible solvent for said ethyl cellulose, in which the relative proportions of graphite to ethyl cellulose lie between 1 to 1 and 10 to 1 and are sufficient to provide an electrically conductive coating on said cathode but below the amount which produces a coating lacking in adhesion and the solvent constitutes between about 70% and 90% by weight of the final composition.

Thermosetting Coating Compositions

*U. S. Patent 2,880,194. Mar. 31, 1959.
D. W. Glaser, assignor to General
Mills, Inc.*

Compositions suitable as protective coatings comprising (a) an aliphatic diamine having an iodine number greater than 75 and the structural formula



in which R is an aliphatic hydrocarbon radical having 8 to 22 carbon atoms and x is an integer from 1 to 4, and (b) a glycidyl polyether of 2,2-bis(p-hydroxy phenyl) propane having an epoxy equivalent of 140 to 1,000.

Corrosion Prevention-Magnesium

*U. S. Patent 2,880,148. Mar. 31, 1959.
H. A. Evangelides*

An electrolytic bath for forming a coating on the surface of articles of magnesium and magnesium base alloys having water as the solvent and consisting essentially of 1 to 60 grams per liter of a compound selected from the class consisting of sodium and potassium chromates, selenates, stannates, tungstates, vanadates, molybdates, and borates, 1 to 300 grams per liter of an anhydrous fluoride selected from the class consisting of sodium and potassium fluorides, 10 to 300 grams per liter of a phosphate selected from the class consisting of sodium and potassium phosphates, 20 to 130 grams per liter of an alkali metal hydroxide from the class consisting of sodium and potassium hydroxides, and 1 to 125 grams per liter of an aluminum compound selected from the class consisting of aluminum hydroxide, potassium aluminate, and sodium aluminate.

Polishing Apparatus

*U. S. Patent 2,880,554. Apr. 7, 1959.
L. G. Simjian, assignor to The Re-
flectone Corp.*

A polishing apparatus for an object positioned within a non-magnetic container comprising, a mixture of abrasive para-magnetic particles and a liquid in said container, electromagnetic means secured in fixed relationship to said container for creating a magnetic force within the container which moves the magnetic particles, and a switching circuit which applies power to said electromagnetic means in a cyclic manner.

Paint Spray Gun

*U. S. Patent 2,880,940. Apr. 7, 1959.
E. C. Briggs, assignor to Sharpe Mfg.
Co.*

A spray gun of novel design.

ABSTRACTS

Hot-Dip Tinning of Cast Iron

E. S. Hedges: Paper read at the *Feuerverzinnung Tagung* (Hot-Dip Tinning Congress) Duesseldorf, November 1958.

Difficulties are encountered in hot-dip tinning of cast iron, inasmuch as the graphite which is present in the surface cannot be wetted by the tin.

Covering of the graphite can be conducted by an electroplating treatment, giving a thin coating of pure iron. Removal of the graphite from the surface is possible by oxidation out of the surface, partly electrolytically by treatment in baths containing molten salts (nitrates, chlorides, alkalies). With the graphite-free crevices which are formed in this manner, an outstanding keying of the hot-dip to the basis metal is obtained.

Modern Developments with Hot-Dip Tinning in Industry

W. E. Hoare: Paper read at the *Feuerverzinnung Tagung* (Hot-Dip Tinning Congress) Duesseldorf, November 1958.

Mechanization is quite possible for the pretreatment of parts and also for after-treatment. Pretreatment requires special attention to avoidance of "thin" areas. Comprehensive tests have been made with spray degreasing for the cleaning stage, and spray pickling lay-

outs have given satisfactory service, particularly with larger size components.

The actual tinning process, from the fluxing medium treatment, through the pre-tinning bath, and to the bright tinning bath, offers only small possibilities for complete mechanization, particularly if value is placed upon a coating brilliance as high as possible. On the other hand, with a correctly arranged spacing sequence of the individual working stages, considerable costs can be saved.

Mechanization after the removal of parts from the hot-dip tinning bath, likewise, depends very much on the nature of the component parts being processed. Large parts, such as meat pans, are treated individually, but smaller parts can be treated in baskets in a centrifuge. Special separating equipment has been devised for soldering lugs and other parts for the electronic industry, which prevents the sticking-together of these small parts. Examples of the mechanization of hot-dip tin layouts, were illustrated.

Porous Chromium Plating of Piston Rings

M. Somfai: Institute for Automobile Research (Hungary), Report No. 3,020, 116 pp.

The report discusses the nature and the manner of the application of a porous chromium coating on the working surface of the piston ring and gives the results of comparative long-term tests with engines fitted respectively, with hard-chromed, porous chrome plated and non-chromed piston rings. The characteristics of the plated chromium coating are discussed.

Details are given of the process by means of which the production is possible of an externally porous coating of given thickness, pore size, and pore distribution. The deviations in the structure of the porous coating are indicated in relation to the plating process — current density and bath temperature, as well as changes in the composition of the electrolyte solution. The porosity can be varied from a tube-like pore structure to a pore-point one.

The most favorable results are obtained with a bath temperature of 50–55°C. and a current density of 50 amp./dm.². For the purpose considered, a plated chromium coating of 0.05mm. is entirely sufficient, which can be processed by anodic etching.

This anodizing treatment is conducted in the same bath.

Comparative long-term running tests, both in the test room and in operation, have shown that the use of piston rings with a porous chromium plated coating of this type considerably increases the service life of the cylinder block. The wear diagrams of the cylinder sleeves prove that the porous chromium coating fixes the lubricant well in the pores and, consequently, creates the most favorable conditions for the running-in of the rubbing surfaces of the engine during the first operational period.

The tests showed that the use of the porous chromium plated piston rings increased the service life of the cylinder sleeves by about 2 to 2½ times, and also improves the operational characteristics of the engines (fuel and lubricating oil consumption are reduced and the time-period between two operational overhauls and repairs becomes longer). The requirement for spare parts is also lowered, etc.

Thick Nickel Electroplated Deposits—A Remedy for Fretting Corrosion

Paper read at the 6th International Congress of Engineering Fabrication, Paris.

Fretting corrosion is accompanied by wear of surfaces in vibratory contact. When a sleeve is dismantled which makes part of an assembly vibrating in service, there are often observed superimposed erosion zones on the faces in contact and the debris of powdered oxide. If a lubricant has been introduced into the assembly, this oxide powder forms a viscous liquid with the oil, red in the case of iron. The spoiled zones are identical and super-imposed on the two faces, and often form discontinuous patches.

The destruction of the surfaces in contact which results can cause such a degree of wear that a play is formed between the two parts which does not permit of the correct remounting of the assembly.

The fretting is produced by an alternating gliding of the contact points of the two surfaces, due to the differential vibrations of the two parts. A relative displacement of 8×10^{-6} cm. is sufficient to cause fretting in certain cases because of the periodic oscillations.

Two theories are advanced to explain the mechanism of these surface

attritions. One is on the basis of molecular attraction. The other theory is based on the modern conceptions of friction. When two solids are in contact, the force which presses them one against the other is concentrated on a small number of high points on each face. These summits flow plastically under the effect of the load and cold weld, and equilibrium is attained when the surfaces of the welded parts is sufficient to support the load.

The author then discussed the use of thick electroplated nickel deposits as a surface coating, as a preparation treatment to reduce the fretting corrosion.

Behavior of Anodized Aluminum Surfaces—Wear Resistance

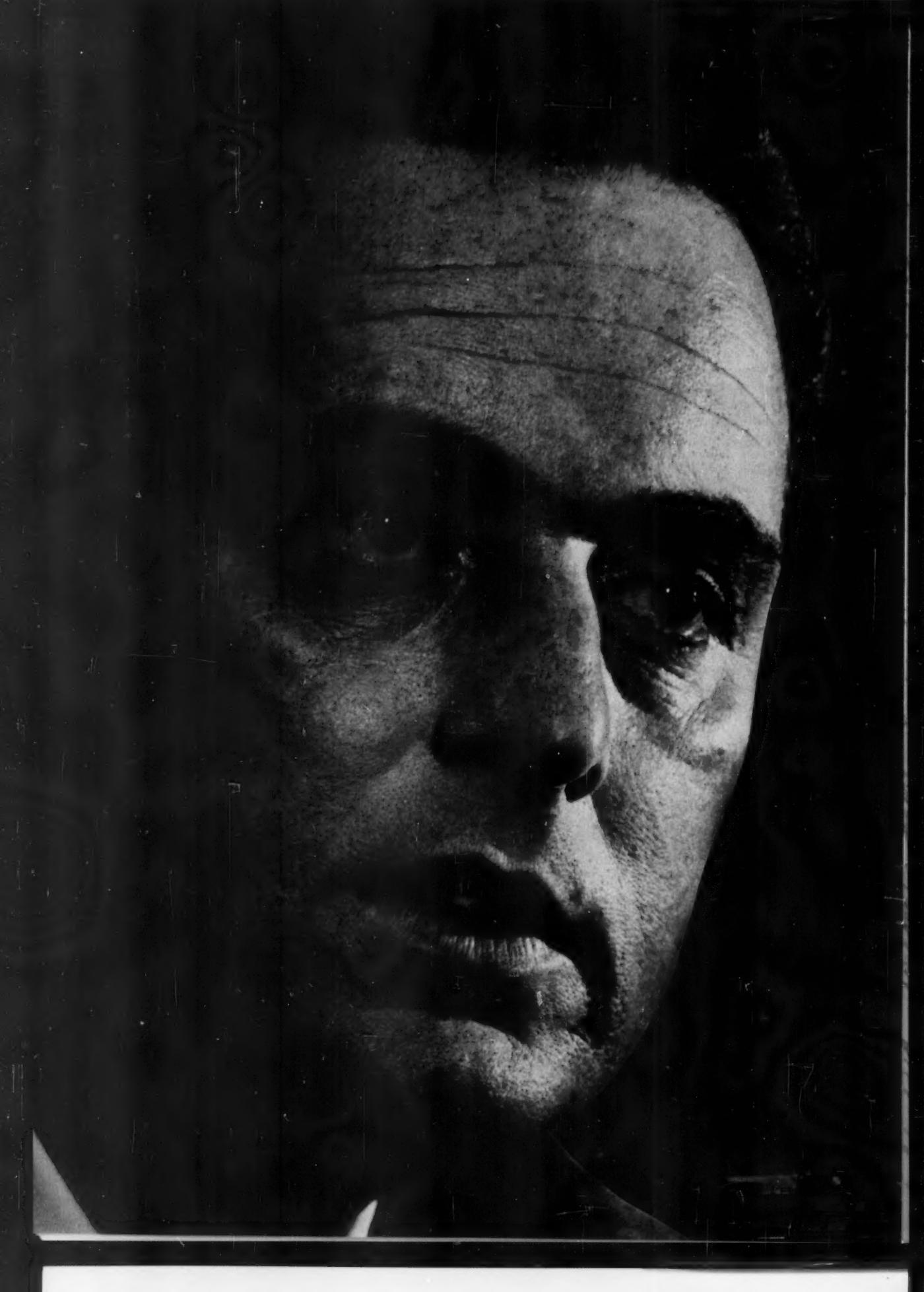
By K. H. R. Wright: Paper read at the 6th International Congress of Engineering Fabrication—Paris.

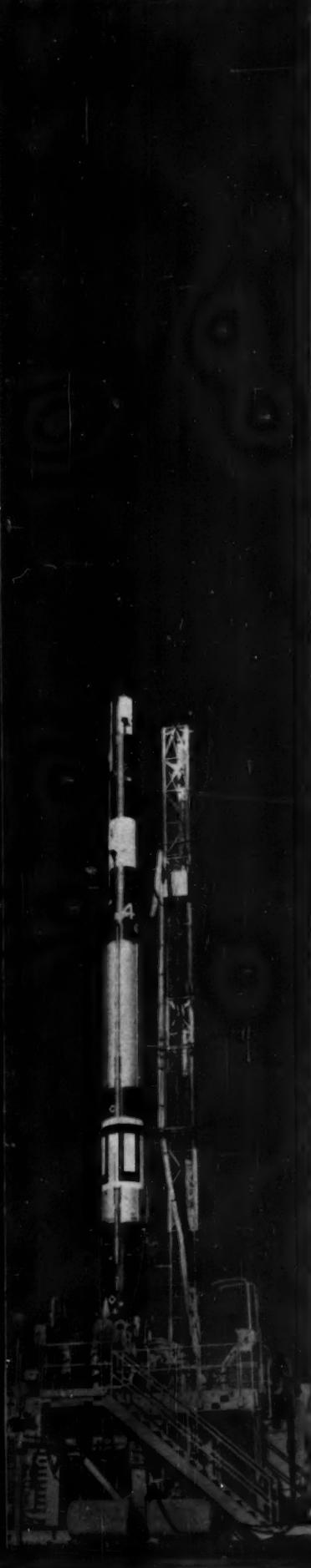
The oxide coatings which form spontaneously on metal surfaces can exercise a very important protective influence under conditions of rubbing. The degree of protection depends principally on the mechanical properties of the metal with regard to those of its oxide. If the hardness of the metal equals or exceeds that of its oxide, the one and the other can deform simultaneously, which avoids an appreciable disintegration of the thin oxide coating.

However, as regards aluminum, these conditions do not exist at all, since the oxide skin, which is hard and fragile, readily disintegrates when it is subjected to gliding contact. The protective action of such oxide skins can be improved by increasing their thickness artificially, by a suitable anodic treatment. The investigations conducted in this direction by the author had as their objective the examination of the behavior of these anodized films under conditions of rubbing.

It was confirmed that the coefficient of friction depends to a great extent on the finish of the anodized surface. This coefficient is lowered in proportion as the finish is improved, and can attain very low values. When it is a question of reducing the friction by employing a lubricant, the porosity of the film of oxide seems to be an important factor. Thus, the protective effect of the lubricant is more or less suppressed with non-porous films.

The mechanism of the disintegration of such anodized films has been





Clete Smith, who helped develop a special solvent formulation for flushing rocket fuel tanks, says you'll like doing business with Columbia-Southern

Technical Service Engineer Clete Smith is one of many Columbia-Southern specialists who recently teamed up to formulate a new solvent for cleaning rocket fuel tanks and other parts without damage to the special metals and alloys used in rocket construction.

Aimed at solving a specific customer problem, this product is one example of Columbia-Southern's emphasis on keeping customers' needs foremost. Throughout the company, the aim is to develop products and methods and to work closely with customers to insure the most effective use of Columbia-Southern chemicals—and service.

For example, Technical Service recommendations on vapor degreasing with Columbia-Southern Trichlor recently saved a large chain-saw manufacturer \$2,100 in tank maintenance costs in just 22 weeks. And an analysis of a window-frame vapor degreasing set-up, also using Trichlor, resulted in a 30% reduction in solvent consumption.

These are just some of the reasons why so many companies in every industry find it pleasant—and profitable—to do business with Columbia-Southern. They like the extra service Columbia-Southern routinely delivers along with its quality products.

Anhydrous Ammonia, Barium Chemicals, Benzene Hexachloride, Calcium Chloride, Calcium Hypochlorite (Pittchlor®, Pittabs®), Carbon Tetrachloride, Caustic Potash, Caustic Soda, Chlorine, Chlorinated Benzenes, Chloro IPC, Chrome Chemicals, Hydrogen Peroxide, Muriatic Acid, Pacific Crystals, Perchlorethylene, Rubber Pigments (Calcene®, Hi-Sil®, Silene®), Soda Ash, Sodium Bicarbonate, Sodium Sulfate, Titanium Tetrachloride, Trichlorethylene

columbia southern

CHEMICAL CORPORATION

A Subsidiary of Pittsburgh Plate Glass Company • One Gateway Center, Pittsburgh 22, Pa.

studied with respect to the lubricant and the hardness of the basis metal. As the load increases, two phases of film disintegration can be distinguished:

1. The appearance of very fine surface fissures, due to the rupture of the coating, which is submitted to tensile stresses during rubbing.

2. The complete disintegration of the film, due to the high plastic deformation of the sub-coatings of metal. This last phase is followed by the formation of metallic welds and, as a consequence, there is produced a catastrophic tearing of the surface. In conclusion, the author discussed the limitations of the practical employment of such coatings as anti-friction surfaces.

Thickness Measurement of Tin and Lead Coatings

J. Kuba and J. Hladik: *Hutnické Listy* (Czecho-Slovakia), 13, #3, 230-232.

The most favorable present method for the measurement of the thickness of metal coatings is the back-radiation process with radioactive isotopes. Using this method, the authors measured the thickness of tin coatings and determined the most favorable thickness range of tin and lead coatings. In the choice of the radioactive isotopes used, the thickness of the basis material must also be taken into consideration, which should not exceed what is termed the end-thickness.

In the thickness measurement of tin and lead coatings, as a control test method for continuous production, the thallium 204 radioisotopes appears the best of the various radioisotopes available for this purpose.

Surface Characteristics of Catalytic Nickel Coatings

By A. Portalupi and E. Melgara. Paper read at the 6th. International Congress of Engineering Fabrication, Paris.

Coating tests were made on very mild steel and on cast iron. For dimensional limits and surface roughness, tests were conducted on hard steel cylinders, ground with wheels of differing grain, with the object of obtaining steel surfaces of a graduated roughness.

The values measured before and after nickel coating (with a coating of

2 microns) are shown in the table.

It was found that the roughness of the best-finished steel surfaces increased as a result of the treatment, while the coarser surfaces are reduced.

Values of Surface Roughness Measured (in microns).

Test Part.	Unplated R.M.S.	Plated R.M.S.
1	2	8
2	11	14
3	40	45
4	70	60
5	130	105

Hardness Characteristics of Nickel Coatings

H. Benninghoff: *Galvanotechnik*: 50, #3, 129-130.

Soft Nickel Plate:

Soft nickel coatings are employed where maximum ductility is desired but where a high degree of hardness is not necessary. These coatings have special advantages as compared with copper coatings, particularly as regards their malleability; they can be hammered, bent, pressed, etc. The composition of the soft nickel bath is as follows:

Nickel sulfate	330 g./l.
Nickel chloride	30 g./l.
Boric acid	30 g./l.
Temperature	60°C.
pH	2.0

Current density

Without agitation,	2.5-5.0 amp./dm. ²
With agitation,	10 amp./dm. ²

Characteristics of the coating:

Hardness: Vickers	140-160
Tensile strength	36 kg./mm. ²
Elongation	30%

With a current density of 5 amp./dm.², a coating of 60 microns is formed in 1 hour.

Medium Hard Nickel Plate:

Nickel coatings from chloride baths are fine-grained, smooth, hard, and have a somewhat higher tensile strength, but are less ductile than nickel coatings from the soft nickel bath above. Laboratory investigations showed that the chloride bath offers certain advantages as compared with the sulfate bath, as for example, 50% lower bath voltage and current consumption; simplified bath control and supervision because of the simple bath composition; wider working range; high anodic and cathodic current efficiencies; lower tendency towards pitting; there is little tendency towards forming nodules even with thick coat-

ings. The bath composition is as follows:

Nickel chloride	300 g./l.
Boric acid	30 g./l.
Temperature	60°C.
pH	2.0

Current density

With agitation	10 amp./dm. ²
Without agitation	2.5-5 amp./dm. ²

Characteristics of the coating:

Hardness: Vickers 230-260

Tensile Strength 70 kg./mm.²

Elongation 21%

Deposition rate at 5 amp./dm.² is 60 microns/hour.

As lead is very strongly attacked by the bath, the lining should be of hard rubber, plastics, fiberglass, etc.

Hard Nickel Plate

Hard nickel coatings find main application because the ductility is superior to hard chromium. If the extremely high hardness of hard chromium is not required, then hard nickel can be used with advantage. In the case of surfaces which are subjected to hard wear or corrosive influences, hard nickel coatings stand up very well to these requirements.

Hard nickel is a pure metal with a very fine-grained structure. It has a low stress-relief temperature; its hardness changes only at temperatures above 230°C.

Silver-Thallium Plated Alloys

F. Sauter: *Diss. Tech. Hochsch. Stuttgart*.

This investigation was conducted by the author at the Research Institute for Precious Metals, Schwaebisch Gmuend, Germany. The work covered the structure and characteristics of electroplated silver-thallium alloys.

Silver-thallium alloys have been proposed for the production of bearing shells, as they possess outstanding running characteristics and have a good corrosion resistance.

The alloy deposits were obtained from a normal silver bath with 32 g./l. Ag as potassium silver cyanide, 25 g./l. potassium cyanide, 30 g./l. potassium carbonate and thallium contents of 3 and 6 g./l. Tl as thallium sulfate. Deposition was conducted at 20°C. from still electrolytes.

Deposits up to 15% thallium hardly differed from that from the pure silver bath. Only with higher thallium contents did the deposits become dark-gray, rough, and powdery. The thallium content falls with rising current density.

The micro-Vickers hardness of the alloy was 82 kg./mm.² with 5.5% thallium and rose to 90 kg./mm.² with 10% thallium. As opposed to the electroplated silver-lead alloys, the addition of the second component thus causes only an inconsiderable hardness increase.

Characteristics of Chemical Nickel Coatings

Galvanotechnik: 50, #3, 144-47.

Chemical composition: 6.9% phosphorus (average 7%) combined with nickel in the form of phosphide compounds.

Thermal expansion coefficient: 13×10^{-6} cm./cm./°C.

Melting point: 890°C.

Specific resistance: 60 micro-ohm/cm.

Coating uniformity: Irregularities in the thickness of the nickel coating do not exceed 5% of the average coating thickness.

Adhesion: No loosening or flaking is observed, if the nickel-coated parts are subsequently formed. If the test parts are bent through an angle of 180° around a rod, no flaking of the nickel coating occurs. If the part thus bent is examined under the microscope, flaws can only be seen at the internal surface.

Hardness: 500 Vickers—49 Rockwell C.

If a nickel coated part is heated for one hour at 400°C., the hardness of the coating exceeds 900 Vickers and this hardness is retained, provided that the parts are used at temperatures below 400°C. If the part is heated for one hour to 900°C., it loses a part of its surface hardness. Resistance conditions and the best thermal expansion are achieved by a thermal treatment of 90 minutes at 600°C.

A catalytic nickel coating is of particular advantage with rubbing parts, either lubricated or dry, at a temperature of less than 400°C. The thermal treatment increases the corrosion resistance.

Porosity: No traces of pores in the coating are to be ascertained if deposits of 5 microns of nickel or more are subjected to 85°C. hot water and then exposed to air. Rust traces which can appear on a coating whose thickness is 2 microns or less, show no tendency to spread.

Soft Solder: Assembly and joining by soft-soldering can be accomplished exceptionally well. Good results are

obtained when resins are used as the fluxing medium. The main precaution to take to obtain full success, is to heat the soft solder to a sufficient temperature. Aluminum can be tinned if it is first covered with a very thin coating of electroless nickel; i.e. with a coating thickness somewhere in the region of a micron.

Arc-welding: It is not considered good practice to weld parts that have been already nickel-coated, if it is a question at all of a thick coating, as the permanency of the weld-joints is impaired by the phosphorus present.

Coatings of chromium, copper, silver or gold can be applied over the nickel in the normal way by electroplating.

Current Distribution in Concentrated Electrolyte Solutions

P. Csokan: *Metalloberflaeche*, 11, #9, 285-288; #10, 316-320.

The measured results described, detailing the shape and expansion of the ion-discharge zones appearing at the intermediate boundary, confirm the existence of an electrolytic field density, easily influenced by various test conditions. It can be considered as proved that the ion migration, i.e., the electrolytic current conductivity is not uniform everywhere, but follows any ruling direction of the electrical current lines of the field.

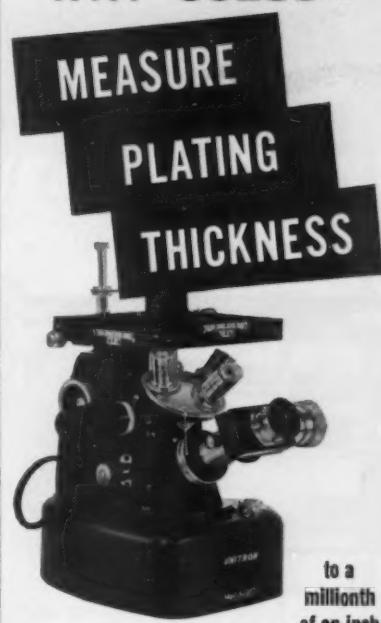
Corresponding to this, the current transport proceeds in accordance with the geometry of the cell electrodes along the "conducting tracks" which can be parallel or else diverging or approaching.

The dissolved electrolyte particles, i.e., the hydrated or complex ions, are polarized by the external field strength acting between the cell electrodes. With this and, as a result of the relaxation effect, "dipole ions" are formed. The polarizability determines also the throwing power of the solution.

For the characterization of electrolytic field strength, the principles of classical electrostatics can be employed, in general. In this way, the electrolytic influence can lead to the formation of a "bipolar electrode" at the intermediate boundary.

The mathematical solution of problems of electrolytic current distribution in concentrated mixed solutions is not possible at the moment. Investigations are being continued so as to provide data on the question of the electrolytic current transport.

WHY GUESS?



to a
millionth
of an inch

Your profits depend on meeting tight specifications, maintaining quality control and reducing rejects. Can you afford to guess at plating thickness when it is so easy to measure and be sure?

UNITRON'S PL-MEC PLATER'S MICROSCOPE substitutes facts for uncertainty. The plated deposit is observed through a Filar Micrometer Eyepiece and measurements are read directly from a micrometer drum. This compact microscope is easy to use, portable around the shop and has a built-in light source. It also doubles as a metallographic microscope for examining grain structure etc. at magnifications of 25X-1500X. Permanent photographic records may be made using an accessory 35mm. camera attachment and provide valuable legal protection for subcontractors.

UNITRON'S PLATER'S MICROSCOPE will save its initial cost many times over. Prove this for yourself — as so many firms in the plating industry have done — by requesting a FREE 10 DAY TRIAL in your own plant. There is no cost and no obligation.



Above: Accessory camera attachment.
Left: Observing the plated deposit.

\$468 Model PL-MEC complete with all optics and standard accessories

As above with built-in camera attachment, but without 35mm. camera back: \$540

THE TREND IS TO UNITRON

UNITRON

INSTRUMENT DIVISION OF UNITED SCIENTIFIC CO.
204-206 MILK STREET, BOSTON 9, MASS.

Please rush UNITRON's Microscope Catalog 13-X.

Name _____
Company _____
Address _____
City _____ State _____

Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT
FOR THE METAL FINISHING INDUSTRIES



Plating Time Calculator

Enthone, Inc., Dept. MF, 442 Elm St., New Haven, Conn.



The plating time required to obtain any desired thickness of plate at any current density may be readily determined by using the Plating Time Calculator. By simply setting the plating thickness desired opposite the metal to be plated, the plating time required is read opposite the current density to be used. The times necessary for plating nickel, chromium, cyanide copper, acid copper, cadmium, zinc, silver and stannate tin can be read directly.

On the reverse side of the slide calculator is the Enstrip Selector which tells at a glance the proper metal stripper to use to strip a wide variety of plates from a number of different basis metals. Methods for stripping nickel, copper, brass, chromium, cadmium, zinc, tin, soft solder, silver and gold from basis metals such as steel, copper, brass, zinc die castings, aluminum and magnesium are included. Operating data for all of the strips are conveniently listed on the selector.

Bright Copper Process

Hanson-Van Winkle-Munning Co., Dept. MF, Church St., Matawan, N. J.

Copper-Lume, a new bright cyanide process, offers the following characteristics: smooth, bright deposits over an extremely wide temperature and current range; good metal distribution; solution simple to operate and control; deposits can be buffed with ease, if required.

Bath constituents can include either potassium salts, a mixture of potassium and sodium salts, or sodium cyanide only. The deposits do not require

activation before subsequent nickel plating, it is stated.

Chromium Plating Chemicals

Metal & Thermit Corp., Dept. MF, Rahway, N. J.

Chromium plating chemicals are now being packaged in pelletized form for substantially improved user safety and convenience. This is claimed to be the first time any chromium plating chemicals have been offered in this form.

The pellets, approximately $\frac{1}{4}$ by $\frac{3}{4}$ in. size, can be shovelled or poured readily without dust from new standard



nine-gallon, Saran-lined, fiberboard containers. There is no caking and far less tendency for the chromic acid material to pick up moisture or adhere to the sides of the new container.

Low-Foaming Spray Cleaner

Northwest Chemical Co., Dept. MF, 9310 Roselawn, Detroit 4, Mich.

An extremely low-foaming single or multiple stage spray cleaner for general use, called Jet 108, is designed for use on all ferrous and non-ferrous metals except aluminum at 100° F. to 140° F. operating temperatures. It easily removes drawing compounds, oils, and greases; inhibits rust; and is ideal for use following soak cleaners. The unusually potent penetrants, surfactants, and dispersing agents give it unusual cleaning efficiency and

longer use life than has been previously possible in this type of product, it is claimed.

The higher the concentration of this new spray cleaner, the less it foams. A heavy dirt load is carried without redeposition. The material is an easily handled, moist, granular alkali base product that is non-toxic, dustless, and non-caking. It presents no disposal problem.

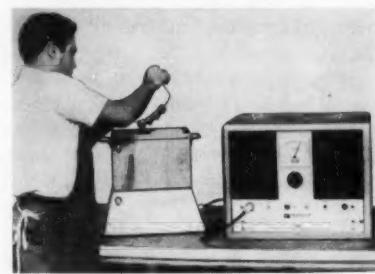
Ultrasonic Cleaners

Acoustica Associates, Inc., Dept. MF, Fairchild Court, Plainview, N. Y.

A completely new line of Multipower ultrasonic cleaners is claimed to deliver up to three times more cleaning power than other ultrasonic cleaners having the same output power ratings. The key to this improvement in ultrasonic cleaners is the newly developed transducer for which patents are pending, which compresses piezoelectric ceramic material between two solid metal sections, providing increase in ultrasonic cleaning power while insuring tremendous durability.

The transducer has an efficiency rating of 90 per cent compared to 60 per cent for the common polycrystalline piezoelectric transducer and 35 per cent for the magnetostrictive type, the two basic older types.

Three standard, off-the-shelf systems



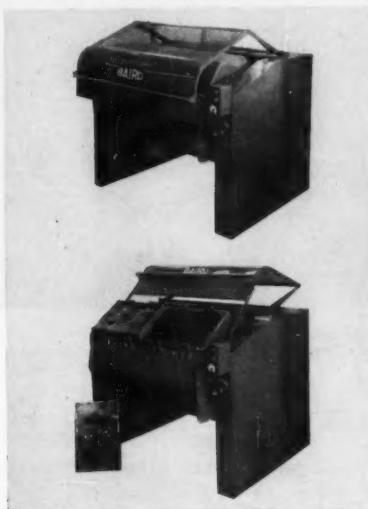
are included in the new ultrasonic cleaner line. Model DR 252 generator with its associated T3 tank provides average output power of 250 watts and a tank capacity of 3 gallons. Price is \$920. Model DR 520 generator with its associated T5 tank provides average output power of 500 watts and a tank

capacity of 5 gallons. Price is \$1,570. Model DR 1020 generator with its associated T10 tank provides average power output of 1000 watts and tank capacity of 10 gallons. Price is \$2,790.

All models operate at 20 kc., a relatively low ultrasonic frequency, which permits the most efficient power output for most cleaning operations.

Barrel Finisher

Baird Machine Co., Dept. MF, Stratford, Conn.



The Finishmaster, a new and extremely rugged horizontal barrel finishing machine with $\frac{1}{4}$ " steel plate on the frame, is so compact that it requires floor space of only five square feet. With lightweight doors of armor plate that can be lifted by hand, the unit is low (less than 4') so all loading and unloading equipment can be carried over the top of the machine. Furthermore, the barrel guard swings out of the way to make the barrel opening very accessible for easy loading. The controls are at the front of the unit, making it possible to place machines side by side, as an additional space-saver.

The machine is also mobile, being equipped with a lifting plate under the drive unit so the entire unit can be lifted with a fork lift truck and moved to any location desired. Other features are a variable speed drive for barrel speeds between 8 and 24 r.p.m. to finish any material; a built-in brake-motor which holds the barrel in position, and a limit switch which permits

jogging but not running of the barrel when the guard is raised.

As standard equipment, the machine also includes an automatic timer, an automatic pressure relief valve in cover, barrel speed controls, and a drive unit that contains a heavy duty helical gear speed reducer which has been designed to take punishment and to give years of trouble-free performance.

The total capacity is 2000 lbs. and the total weight of the machine with the barrel is 2500 lbs.

Automatic Polishers

Acme Mfg. Co., Dept. MF, 1400 E. Nine Mile Rd., Detroit 20, Mich.

An improved standardized automatic

Once you use it
you'll Order...
Again...
and
Again...
and
Again!



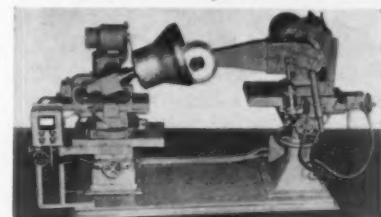
Every can filled with a full weight of extra high quality 99.75% Chromic Acid.
Prompt delivery made from ample factory and nearby distributor stocks.



BETTER FINISHES & COATINGS, INC.
268 Doremus Avenue, Newark 5, N.J. • 2014 East 15th St., Los Angeles 21, Calif.

polishing machine will finish reflectors, oval shapes, bubble-type surfaces, conical, cylindrical and bowl shapes in a fully automatic cycle of operation. Parts made of aluminum-clad material, stainless steel, low-carbon steel, copper, brass can be effectively finished on the new reflector polishing machine.

One unique feature of the machine is the automatic control of finishing wheel pressure to prevent excessive



pressures encountered when contact surfaces change from large to small radii as in oval reflectors. Air line pressure directed to the cylinder controlling the wheel contact pressure is automatically varied by a cam and switch arrangement to suit part configuration requirements.

Another feature of the machine is the automatic reversal of wheel rotation during the finishing cycle. This enables both cutting and coloring operations to be performed in one work cycle.

Basically, the machine consists of a modified Model G-4 adjustable lathe with a special spindle housing mounted on a semi-automatic machine base, and a Model E-10 semi-automatic machine with a standard right angle attachment; all mounted on a single machine base. Electric motors drive the work spindle and finishing wheel. Complete adjustment for all of the machine motions, wheel and work spindle locations give the machine broad work flexibility.

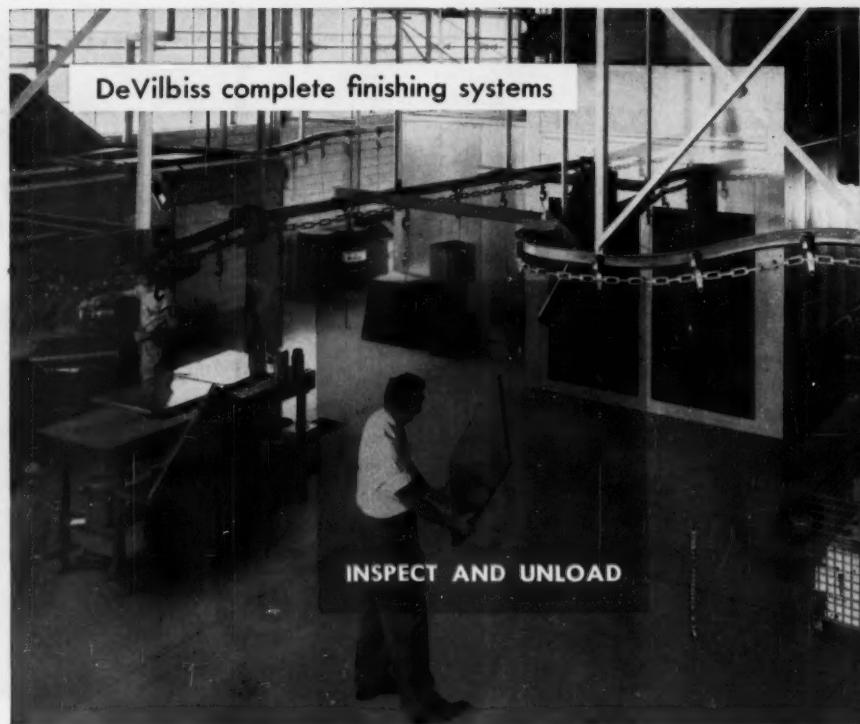
To finish a reflector, the work spindle is swung out 90-deg. and the part loaded in place. Then the spindle is swung back into centerline relationship with the polishing wheel. The polishing wheel is advanced to engage the reflector surface. Then the automatic polishing cycle is initiated. The reflector is rotated while the polishing wheel is reciprocated back and forth in contact with the work. The wheel reverses its direction of rotation during the process. Wheel pressure is automatically controlled during the finishing cycle. At the end of the work cycle, the spindle swings out automatically for unloading the part.

In the machine illustrated, which is ideally adapted to the polishing of reflectors for street lights, hair dryers and large lighting fixtures, the polishing wheel is powered by a $7\frac{1}{2}$ -hp motor. The work spindle is driven by a $\frac{1}{2}$ -hp motor. The reflector polishing machine occupies a floor space approximately 3-ft. by 9-ft. and has an overall height of approximately 52-inches. Motor horsepower and other machine details can be varied to suit specific part polishing requirements.

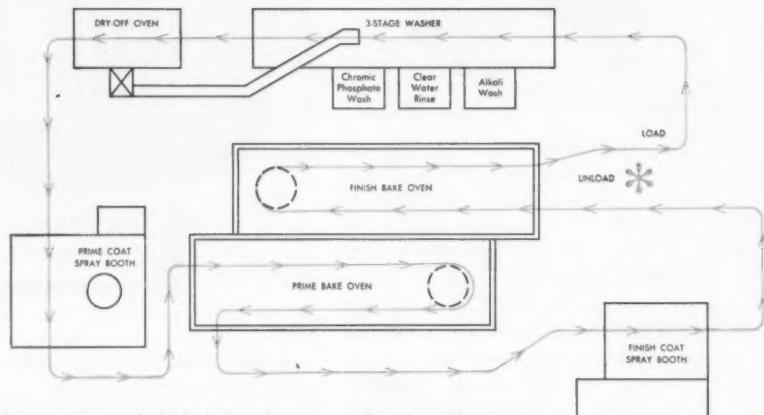
Flexible Abrasive Wheels

American Buff Co., Dept. MF, 2414 S. La Salle St., Chicago 16, Ill.

Amflex buffs are not grit-coated, but contain grain-in-depth that retain maximum abrasive efficiency throughout the entire life of the buffing wheel.



The system occupies less than 3200 sq. ft.; includes cleaning, and application and bake of both prime and finish coats.



With conveyor speed of 3 ft./min., 90 units complete the cycle every hour. Water-wash booth with turntable, and a conveyorized dip operation for miscellaneous parts supplement main system shown.

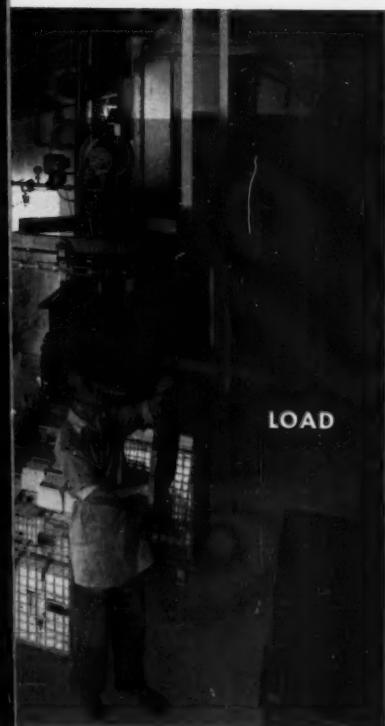
The abrasive wheel is construed of an extra-loose design, similar to that of the manufacturer's open-face cloth and sisal buffs, thereby retaining advantages of their air-cooled design, permitting higher operating speeds.

There are 16 sizes with 3", 5", 7", and 9" centers. Wheels are available in 80, 120, 240 and 320-grit to meet every metal-cutting need.

Black Oxide Finish for Steel

Mitchell-Bradford Chem. Co., Dept. MF, Wampus Lane, Milford, Conn.

A new "activated" Black Magic for producing a black oxide finish on steel is a new approach to the process because of its constant, automatic, self regenerating, decontaminating, catalytic action along with other vitally im-



Uniformity of finish is a must at Fisher. "Panels from many separate runs go into cabinets like this, and must match perfectly," says Chief Engineer Frank Skowron (left).



portant and unusual characteristics. It contains entirely new concepts of activators, catalysts, penetrants, and rectifiers, reduces processing time, lowers salt consumption because of excellent drain off and less salts per gallon. It is extremely free rinsing and produces a denser black and clean finish. The dragout is 25-30% less than conventional blackening solutions, it is said.

How to coat 16,000 shapes and sizes with speed and precision

A laboratory is a complex of strange shapes . . . of equipment specialized to the nth degree. Even so, it is astonishing to realize that the Instrument Division of the Fisher Scientific Company turns out a total of 80,000 separate components in manufacturing the world's most comprehensive selection of scientific instruments, apparatus, and laboratory furniture. Of these, about a fifth (16,000) get protective coatings . . . and the heart of Fisher's finishing department for this vast array of parts is the DeVilbiss conveyorized system you see here.

DeVilbiss worked closely with Fisher engineers to develop this remarkable new system. It has been in service for over a year, applying precision coatings that resist the powerful corrosives in laboratory use. It has proved its efficiency by absorbing the plant's continually increasing production load without a hitch.

With the industry's most complete line of surface-preparation and coating and finishing equipment to draw on, DeVilbiss can supply you with matched components in a system tailored to your particular requirements. It is the one "single source" fully qualified to analyze your needs, then let you select the best, most economical product combination to fit your job. May we serve you?

THE DEVILBISS COMPANY

Toledo 1, Ohio

Barrie, Ontario • London, England • São Paulo, Brazil
Branch Offices in Principal Cities



INDUSTRIAL POWER WASHERS • OVENS • DUST COLLECTORS • MIST-COOLANT UNITS • SPRAY EQUIPMENT • HOSE & CONNECTIONS • FLOW & DIP COATERS • SPRAY BOOTHS • AIR COMPRESSORS

ously self rectified formulations. By this new and novel method of rectification any contaminants which may be inadvertently introduced into or possibly formed in the solution during processing are immediately reacted with and forced to the top. These contaminants can then be either skimmed off or, during normal production cycles, are automatically removed in the dragout and rinsed very easily away in the rinse water.

The process meets or surpasses all government or commercial specifications for a black oxide finish, it is stated.

Paint Strippers

Heatbath Corp., Dept. MF, Springfield 1, Mass.

Durastrip A-1 is an alkaline-type powder that has been designed for stripping lacquers, enamels and phenolic coatings. A concentration of 1½-3# per gallon of water is recommended with the solution being operated at the boiling point.

Durastrip #2 is a two-phase, solvent-type paint stripper that removes paint films by wrinkling rather than dissolving them. This material is used as received, at room temperature, to quickly remove highly resistant paint finishes such as epoxy resins, acrylics, vinyls and polyesters. It can be used to remove paint finishes from steel, aluminum, copper, cadmium and zinc. Stripping is accomplished in the lower solvent phase of these solutions.

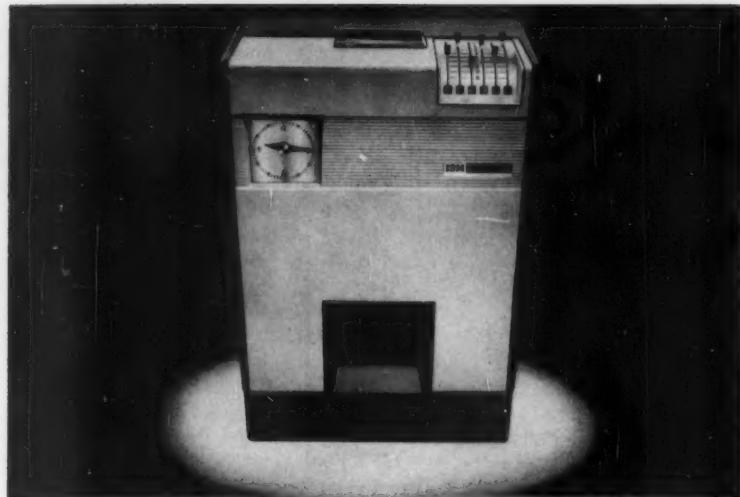
Paint Stripper

Beck Equip. Co., Dept. MF, 3350 W. 137th St., Cleveland 11, Ohio.

Epoxystrip #NC-194 non-corrosive paint and finish remover easily removes tough modern finishes such as epoxies, polyurethanes, and the new acrylics, as well as the conventional paints, lacquers and enamels.

After a brief application, the treated finish swells, pops loose and is flushed away with water. The metal surface is left clean with no removal of, or damage to, phosphate coatings. When dry the part is ready for refinishing.

The new remover is an ideal stripping agent for preparing rejected parts for refinishing and also for removing paint from work holders. The manufacturer states that its product will perform at top efficiency, whether used from a drum, in a dip tank, or in a continuous production line.



ARMORSOL® coating on PLASTICS

New vinyl coating for thermoset plastics and polyester fiberglass.

Basically a one-coat finish, competitive with baked enamel, Armorsol can be made smooth or textured for approximately the same cost as baked enamel. Yet it is five times as abrasion resistant.

Armorsol is a new and entirely different kind of vinyl coating, and has physical and chemical properties unlike any other finish. Armorsol is the best coating for thermoset plastics.

Write today for free booklet and sample panel.

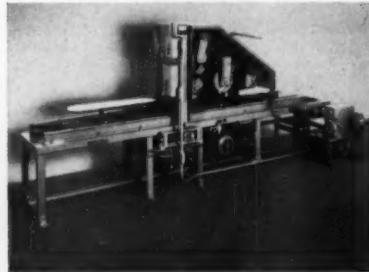
JOHN L. ARMITAGE & CO.
Synthetic Enamels, Paints, Varnishes, Lacquers
245 THOMAS STREET • • NEWARK 5, NEW JERSEY

Abrasive Belt Head for Curved Surfaces

Murray-Way Corp., Dept. MF, P. O. Box 180, Birmingham, Mich.

A new abrasive belt head for grinding and polishing convex or concave surfaces of aluminum, brass, and steel castings provides positive belt control at heavy work pressure by a special air-operated scanning eye which prevents belt run-off. The machine's rigid construction and formed contact wheel enable closer tolerance and truer shape on the finished product.

The new head considerably shortens the time required to buff convex and concave surfaces, a job previously done manually. As the abrasive belt oscillates, tension take-up is air controlled.



The contact roll is supported by a sturdy out-board bearing arm, and an ammeter is provided to show work effort. A continuous chain reciprocates the platen-mounted fixture.

This new belt head will be a standard item in the manufacturer's line of polishing, buffing, and grinding heads.

Portable Solution Filters

Industrial Filter & Pump Mfg. Co., Dept. MF, 5900 Ogden Ave., Cicero 50, Ill.

Two recently introduced plating filters feature compactness and mobility. They are designed to eliminate piping and valves between tanks and the need for separate filter stations. Designated



as the improved Type 118, one provides 600 g.p.h. flow capacity and up to 15 square feet of filtration area. The other is rated at 1200 g.p.h. and has 60 square feet of filtration area. Six inch diameter rubber-tired wheels and full-swivel rear coaster enhance mobility and speed at which the filters can be put to use.

Both units occupy less than 6 sq. ft. of floor space and are equipped with quick releasing cover to facilitate change and inspection of cartridge-type filter element.

Furnished as a complete package, the filters come equipped with the following: rubber-lined centrifugal pump; 10 feet of suction hose; 15 feet of discharge hose; a combination ball check foot valve and strainer; motor and starter with thermal overload.

Abrasive Belts and Discs

Behr-Manning Co., Dept. MF, Troy, N. Y.

A new line of resin-bonded aluminum oxide coated abrasives has a sharpness and cutting life never before attained, it is claimed. Marketed as Metalite Type 101, the new abrasive is available on fiber discs and cloth belts, both characterized by a uniform and attractive brown color.

A modification, labeled 101T and applied to fiber discs in the grit range from 24 to 60 inclusive, has proved

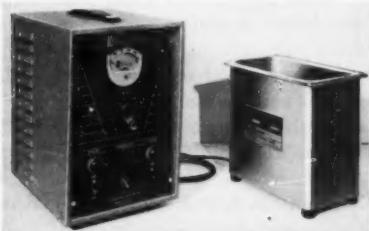
particularly effective on stainless steel, brass, bronze and other alloys, where increased abrasive life is accompanied by a marked freedom from heating and resultant discoloration of the metal. Throughout, the abrasive is said to exhibit extreme sharpness which is sustained even in rigorous service. This fast-cutting behavior, whenever present in a coated abrasive, is accompanied by cool cutting. The new material also gains in durability by keeping shedding to a minimum.

The fiber discs are made in a grit range from 150 through 24; belts from 180 through 24.

Ultrasonic Cleaning Unit

National Ultrasonic Corp., Dept. MF, 111 Montgomery Ave., Irvington, N.J.

A new unit for small part cleaning applications in which average energy levels are required, Model 100 features a one-gallon heavy-gauge polished stainless steel tank, deep drawn with rounded corners to facilitate the rinsing out of contaminants removed by ultrasonic energy. The tank is 9 $\frac{1}{4}$ " long, 5" wide and 6" deep. 25% of the tank bottom is covered with driv-



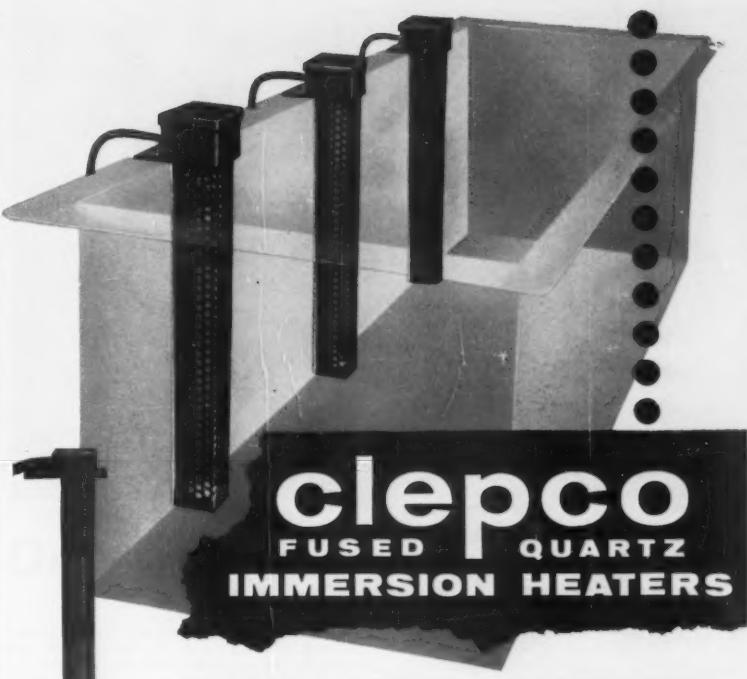
ing elements and actual radiating surface is 12 square inches.

The 115 volt A.C. single-phase, 60-cycle generator, designed for continuous operation, delivers an average power output of 60 watts and produces peaks of 240 watts. Features include one-tube oscillator, front panel switching which permits a choice of either of two transducers, and 3-wire ground protection. Interlocked for operator safety, the unit can be adjusted to available line voltage. The unit, which is in stock, is priced at \$350.00.

One-Coat Protective Coating

Prufocoat Laboratories, Inc., Dept. MF, Cambridge, Mass.

Primastic is a protective coating that combines rust-inhibitive primer properties with the chemical resistance of a catalyzed epoxy coating. According to the manufacturer, the new prod-



FAMOUS THROUGHOUT THE PLATING INDUSTRY

For Quality, Efficiency, Low Cost Operations

OVER 100,000 INSTALLATIONS

For alkaline or acid heating jobs, you can depend on
CLEPCO ELECTRIC IMMERSION HEATERS

CLEPCO STEEL and STAINLESS HEATERS
will meet all your specific needs.

Low Heat Density — Long Life — Vapor-proof junction Box.

SEND FOR COMPLETE INFORMATION

THE CLEVELAND PROCESS COMPANY

1965 EAST 57TH STREET • CLEVELAND 3, OHIO

uct, by affording both primer and top-coat corrosion-control qualities, performs functions formerly requiring the use of two materials.

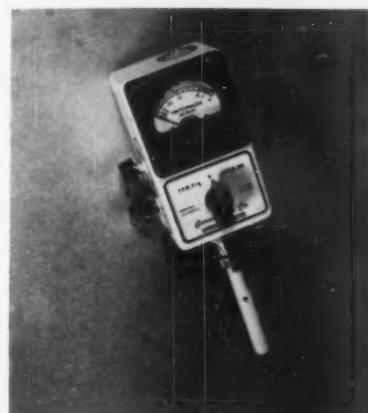
The material requires only one brush or single-pass spray coat for a coating up to 10 dry mils in thickness. One cross-pass spray coat yields 20 mil dry film thickness. Its cost per mil foot barely exceeds one cent. Flash point exceeds 100° F.

Electrolytic Conductivity Meter

Carma Mfg. Co., Dept. MF, 1879 Mullin Ave., Torrance, Calif.

The Hydroion Meter is designed for conveniently measuring the specific conductance of a solution in locations where electric power is not available. The 72734 Meter is battery operated

and reads p.p.m. in saline or other solutions. It has a temperature compensating adjustment and selector to





Picture of a man who sends his refinings to Handy & Harman

He used to send his refinings elsewhere. Now, whenever he talks about refinings, he uses a code: BH&H (Before Handy & Harman) and AIGW (After I Got Wise). Whence the wisdom? Well, he knows, like hundreds and hundreds of Handy & Harman Refining customers,

that he gets FV (Full Value) on every lot he sends us. If you're lucky enough to run into him on the beach, ask him—he'll tell you the same thing we told him. Send your next lot to us. And, then compare our returns with your last returns. There'll be a difference...honestly.

Your No. 1 Source of Supply and Authority on Precious Metal Alloys



HANDY & HARMAN

General Offices: 82 Fulton St., New York 38, N.Y., BEEckman 3-2460
90 Years of Nationwide Refining Service

BROOKLYN 1, NEW YORK
Clearwater 9-8321

CHICAGO 22, ILL.
1900 West Kinzie St.
SEaley 3-1234

TORONTO 20, CANADA
141 John St.
EMpire 8-6171-2-3

LOS ANGELES, CALIF.
330 N. Gibson Rd., El Monte
CUMberland 3-8181

PROVIDENCE 5, R.I.
425 Richmond St.
JACKson 1-4100

read either directly or p.p.m. $\times 10$. Lower cost plug-in AC instruments reading micro-mhos and p.p.m. simultaneously are also available.

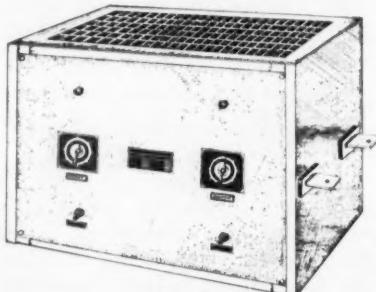
Meter ranges are from 0 to 100,000 p.p.m. with increments down to 0.5 p.p.m. Weight: 1½ Lbs. Price: \$130.

P. R. Rectifier

Djeco Div., Djordjevic Engineering Co., Dept. MF, 1933 N. Damen, Chicago 47, Ill.

This periodic-reverse polarity timing rectifier is used for a uniform deposit in plating. Its operation is cyclic and, during a depositing cycle of several seconds, a layer of metal is deposited over cathode work, then the

current is automatically reversed, according to the manufacturer. During the reversing-deplating cycle, which is a few times shorter than the depositing cycle, a part of the deposited layer is

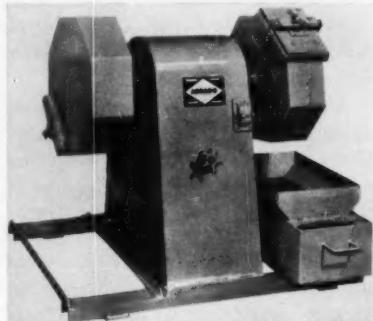


removed. During each deplating interval the metal is removed most rapidly from regions which are much higher than surroundings. This process is said to provide a uniform and smooth deposit over work.

The unit can be installed in the D.C. line between tank and rectifier, or between tank and generator field. It has a D.C. rating of 15 to 3000 amp., and its A.C. input is 60 cycles, single phase, 115/230 volts.

Barrel Finishing Machine

Abrado Finish Corp., Dept. MF, 1750 Elizabeth Ave., N.W., Grand Rapids 4, Mich.



Model B321-2 is a small dual-cylinder, barrel finishing machine suitable for processing small lots of average size parts or a few larger parts. It is said to be ideal for experimental work or limited production requirements.

Over-all size of the machine is approximately 45" long, 25" wide and 36" high. It features compact, modern design and incorporates rigid all steel welded construction to provide efficient operation with minimum maintenance. Two single compartment plastic-lined cylinders, each 18" in diameter and 12" wide, have a capacity of two cubic feet each and are mounted on central drive shaft which is coupled to a variable speed drive, providing cylinder speeds of 20 to 40 rpm. Power is supplied by ¾ H.P. electric motor. Standard electrical control is water proof start/stop switch wired for 110 volt, 60 cycle, single phase operation. Controls and wiring for other electrical power specifications available on quotation.

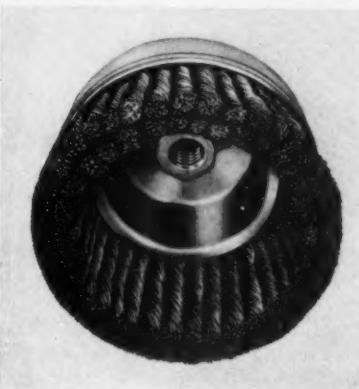
Wire Cup Brush

Anderson Corp., Dept. MF, 1029-1039 Southbridge St., Worcester, Mass.

Known as the UDX-6 model, this 6" cup brush combines four important performance and safety features not

to be found in any other cup brush on the market, it is claimed. The major design improvement is in the turret back of the cup which replaces the conventional flat back. This curved back is designed to absorb operational stresses at high speeds, making it possible to run these brushes at up to twice the former possible maximum speeds (as high as 7,000 RPM), thus affording much faster cutting and easier cleaning.

A second new feature of the cup itself is the rolled bead edge which replaces the former sharp corner edge, and consequently eliminates breakage



of outside wires even under severe usage.

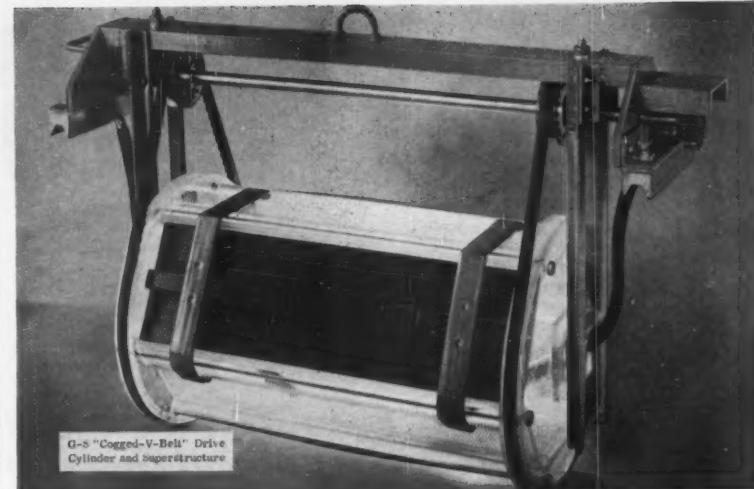
The third exclusive feature is the internally mounted nut which a) makes the brush absolutely fail-safe since the nut automatically screws on tighter in operation and b), brings the brush closer to the power tool or machine for perfect balance and hence less bearing wear and operator fatigue.

Belt Polishing Machine

Timesaver Sanders, Dept. MF, Box 7446, Robbinsdale Station, Minneapolis 22, Minn.

The new "Speedbrite" polisher is a dual head machine incorporating a wide abrasive belt head and a 3M "Scotch-Brite" wheel. It can be used for polishing metal sheets, flat stampings or extrusions and strip stock. Material is fed onto a continuous conveyor belt that passes under both heads and enables increased production for this type of operation.

The abrasive belt sanding head is mounted on a patented "A" frame support and provides a "floating action" that can be adjusted to fine tolerances to control stock removal. Mounted forward in the unit, the abrasive belt head removes scratches and scars in the sur-



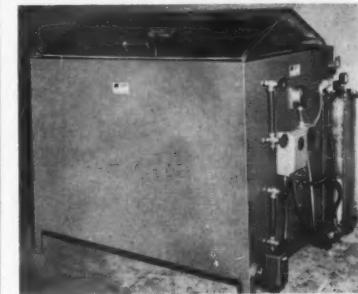
Only G-S meets the New Challenges of Modern Plating!

Only G-S has the features to cope with the demands of automation, closer tolerance processing, heavier loads, hotter solutions, better, faster plating.

Temperatures to 220°F. Load to 275 lbs. Heavy-Bodied, All-Bolted or All-Welded Cylinders. Bussed for more amps. G-S "Cogged-V-Belt" Drive — no gears in solution. Inverted V-Contacts or Horn Type. Floating End Plates — constant contacts. Adjustable Bearings — constant

mesh with drive gears. Floating Hubs with Locking-U — direct danglers down — faster disassembly. Heavier Dangler Cables — higher currents. And many more exclusive features.

Switch to G-S: G-S Replacement Cylinders to fit all make superstructures. G-S "Cogged-V-Belt" Drive Cylinder-Superstructures to fit all tanks. G-S "Cogged-V-Belt" Drive Barrels etc. Also, Tanks, Liners, Hoods, Motor Drives, Chute Loaders, etc. Send for bulletins, prices.



Test 'em Yourself. Cut Time, Costs G-S CORROSION TEST CABINETS

- Salt Fog • Acetic Acid • Humidity
- Corrodkote • Case Tests

Your customers want more tests — up to a piece-per-hour. Answer: in-plant tests with low-cost G-S Cabinets. Avoid outside delays, red-tape, high costs. G-S Cabinets for highest accuracy — meet A.S.T.M. and Gov't Specifications. Lined Steel, Lined Stainless, or "H-T Plexiglas". Send for details, prices.

Manufactured by The Singleton Co.

The G. S. Equipment Co.
15575 Brookpark Rd., Cleveland 35, Ohio
Telephone: Clearwater 2-4770

face of the metal, while the rear head does the polishing. Hinged side panels provide easy access to the heads and abrasive belts can be changed in two to three minutes. Unit has hydraulic adjustments for pressure and is fully automatic in operation. A provision for oscillating the rear head prevents

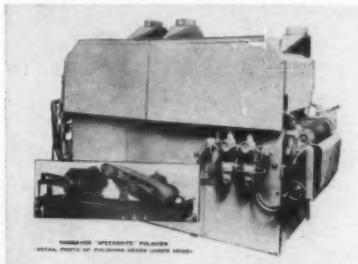
marking of work. Model SB is available in 12" and 18" widths.

Paint Primer

Krylon, Inc., Dept. MF, Norristown, Pa.

Rust Magic metal primer, a new metal primer, spray or brush type, that dries in 20 minutes, is compatible with almost any finish coat, it is claimed.

The primer contains a special phenolic resin penetrant which carries the pigment and vehicle through sound rust and locks itself tight to the substrate. This complete penetration seals the surface, locks out moisture and prevents further rust development. This saturating action neutralizes porous

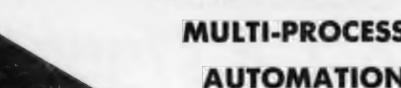


Two more

ABBEY-Matic
Systems

Western Electric Co.
Laureldale, Pa.

General Electric Co.
Allentown, Pa.



featuring

**THE 5 NEW
DIMENSIONS OF
MULTI-PROCESS
AUTOMATION**

Only ABBEY-Matic provides for 1. Variable Systems—large or small, complex or simple, 2. Key Card Dispatch—multi-cycle selection, 3. Leap-Frogging Carriers and Station By-Passing, 4. Variable Timing—station-by-station, 5. Automatic Switch Lines—accumulation, storage and automatic feed (all patented). Learn how ABBEY-Matic meets your needs for today—and for the future. Inquire now!

Distributor: ENTHONE, Inc., New Haven, Conn., a Subsidiary of American Smelting & Refining Company
REPRESENTATIVES:

Austin F. Fletcher, Inc., Barlow Rd., R.D. 6, Binghamton, New York.

R. O. Hull & Co., Inc., 1300 Parsons Ct., Cleveland 16, Ohio.

R. O. Hull & Co., 3136 Hilton St., Ferndale, Michigan.

Ross Industries, Inc., 5890 Commonwealth Ave., Detroit 8, Michigan.

Ardco, Inc., 5000 W. 73 St., Chicago 38, Illinois.

Nicromatic, Ltd., 20 Drummond St., Toronto 14, Ont., Canada.

**ABBEY
PROCESS
AUTOMATION**

INC.
37-01 48th Ave., Long Island City 1, N.Y.
Ravenswood 9-0392

rust and makes it an actual ingredient of the paint film. It dries to the touch in 20 minutes, and can be topcoated in 2 hours. Its elasticity permits expansion and contraction in metal surfaces caused by weather changes.

The primer is available in half pints, pints, quarts, gallons, 5-gallon pails, 55-gal. drums and 16-ounce aerosols.

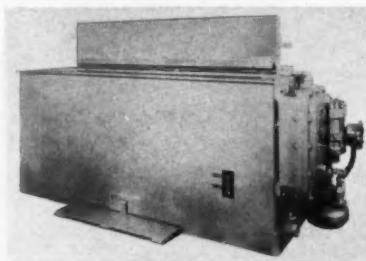
Automatic Washer

*Conforming Matrix Corp., Dept. MF,
349 Factories Building, Toledo 2,
Ohio.*

A completely automatic, high pressure mask washing machine for large size spray decorating masks, designated as Model W-7200, will handle masks up to 72" long, 18" wide and 16"

deep, but can be altered to meet the customer's requirements.

It is estimated that the high pressure spray through non-clogging nozzles permits a time and labor saving of up to 50% over that required by manual cleaning. In many instances up to 20 coats of wet paint can be removed in 20 seconds.



The time cycle operation is adjustable from three seconds to 20 minutes. A foot pedal is provided for opening and closing the non-ferrous splash-proof lid. A visual gauge shows the fluid level in the 100-gallon capacity tank. Intake strainers are provided on the pump. Self-cleaning filters are an optional feature. Pumping facilities discharge the bulk of the contaminated solvent before sludge draining.

Industrial Spray Nozzle

*Wm. Steinen Mfg. Co., Dept. MF, 43
Bruen St., Newark, N.J.*



The solid-cone Tan-Jet, centrifugal type, industrial spray nozzle is available in $\frac{1}{4}$ ", $\frac{3}{8}$ " and $\frac{1}{2}$ " sizes with male or female connections, with capacities of from 0.50 to 10 g.p.m. at 40 p.s.i. The construction is such that there are no moving parts, resulting in long, trouble-free life. The three-piece design, the body, the removable cap and the internal member permits easy cleaning. Nozzles are available in brass, steel, 303 stainless, and in other materials upon request.

Protective Coating

*Industrial Finishes Co., Inc., Dept.
MF, 1119 Land Title Building, Phila-
delphia 10, Pa.*

A new paint product, Parifco, is said to be highly resistant to moisture and constant humidity, salt spray, acids and alkalies. It also dries fast and has a tough film. Gloss and color retention are other qualities obtained by the combination of chlorinated rubber with the alkyd resins.

Safety Solvents

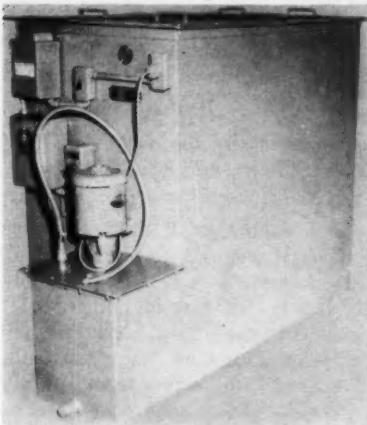
*Harcos Chem. Co., Dept. MF, Cran-
ford, N.J.*

A new series of safety cleaning solvents is claimed to offer industrial users substantial savings in material costs by enabling them to select a formulation meeting their specific cleaning requirements. This eliminates the wasteful use of high-cost solvents for routine cleaning. The series of eleven standard formulations ranges from low-cost 'wash-up' solvents to high

safety factor blends for hazardous locations. Literature lists applications, safety factors, flash points, relative drying time and, rather uniquely, a standard price schedule.

Vapor Degreaser

*Dry Screen Process, Inc., Dept. MF,
1016 Madison Ave., Pittsburgh 12, Pa.*



Model 18-4222 vapor degreaser is a trichlorethylene, self-distilling machine which is supplied with a pump design to overcome seat-leaking problems.

Working area dimensions are 42" long, 18" deep and 22" wide. Overall height of the machine is 43".

The unit is equipped with a manual reset safety thermostat. Capacity is 500 pounds steel per hour.

Ultrasonic Generator

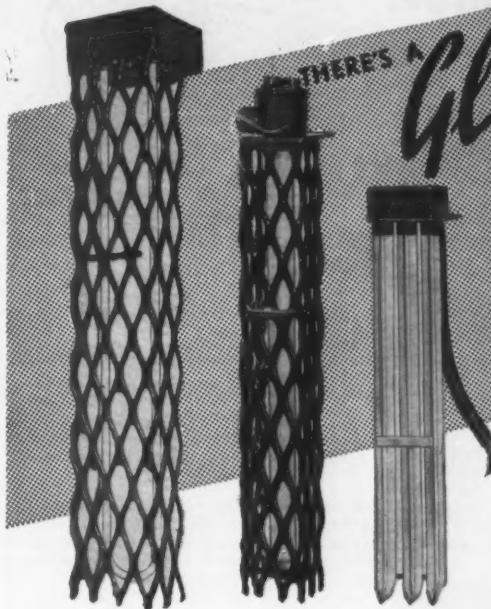
*Industrial Ultrasonic Corp., Dept.
MF, 827 Harrison Ave., Kearny, N. J.*

These new generators, expected to help break production bottlenecks, operate with a simple on-off switch and make use of a fundamental principle of automation, feedback.

The actual amount of ultrasonic activity in the cleaning tank is measured and used as a basis for varying the output frequency of the generator. The frequency is adjusted automatically until maximum activity (cavitation) is obtained. The generators operate at peak efficiency automatically even as the load varies. No other ultrasonic equipment available can duplicate this, it is claimed.

Load changes, resulting from displacement or addition of solvent, heating or cooling or any other cause, will not affect the operation of the system. Substantial advantages can be found in automated or conveyorized cleaning operations. Even simple, single-immersion

The Leading Name in Immersion Heating



THERE'S
GLO-QUARTZ®
IMMERSION
HEATER
for
YOUR EVERY
HEATING
REQUIREMENT

All 3 Types

- INSTANT HEATING
- SHORT-PROOF
- AVAILABLE IN ALL VOLTAGES—WATTAGES, one and three phase
- STOCKED FOR IMMEDIATE SHIPMENT

TYPE "GN"

PATENT PENDING
World's first suc-
cessful U-tube

ACID Heater
—Guaranteed to
outperform and
outlast all other
quartz heaters.

TYPE "U"

Pat. No. 2,740,881
Standard straight
tube Quartz

ACID Heater
—Vapor-proof
junction box; re-
placeable heating
element.

TYPE "MB"

"Multi-Blade",
Metal-sheathed

ALKALI Heater
—Portable, burn-
out proof, easy
mounting, long
life.



If you're looking for
ACCURACY—EFFICIENCY—LONG LIFE—and ECONOMY
...you'll get it with **Glo-Quartz!**

Available from your Electroplating Distributor!

Glo-Quartz Electric Heater Co., Inc.

Trademark Reg. U.S. Pat. Off.

WILLOUGHBY, OHIO

Phone: Willoughby 2-5521

sion operations are speeded and improved.

The equipment is available in a number of system combinations using basic ultrasonic generator models, together with the appropriate cleaning tanks or immersible transducers.

Aluminum Tinning Process

*Allied Research Products, Inc., Dept.
MF, 4004 E. Monument St., Baltimore
5, Maryland.*

A new process for the immersion tinning of aluminum parts, ARP#200 Stannate "M" is a special compound for make-up and maintenance of stannate type tin baths. Used in a concentration of $7\frac{1}{2}$ oz./gal. it produces a

smooth, adherent tin coating on the work from only a 4 minute immersion in the bath at 165°F.-175°F. Little sludge is formed and there is no need for control of hydroxide content or for acetic acid additions. The only control procedure required is that of periodic checks of the tin content. Further, the bath does not build up excess tin deposits in machined areas, such as wrist pin holes. Nor is any dumping of the bath required. Periodic additions will maintain the bath in proper operating condition almost indefinitely, it is claimed.

The material is supplied in powder form in 25, 100 and 400 lbs. packages.

TWO TESTS SHOW Redline® BUFF CLOTH

GIVES UP TO 20% INCREASE IN BUFF LIFE



Test I — Square aluminum skillets—Semi-automatic machine 20" x 7" center 18 ply.

REDLINE performed well with the same compound used on unbleached cloth.

Continued to cut well, to a smaller diameter than the previous cloth. About a 20% increase in buff life.

Test II — Aluminum shower door strips—Hand buffering 16" x 7" center 16 ply.

REDLINE cuts better, was stiffer than unbleached 86/93 Company claimed that REDLINE lasted twice as long.

Results!! To what extent has Redline been successful? In the last six months over one half million yards of Redline has been purchased by buff manufacturers. Buffs of Redline cloth are being used in plants throughout the country on work ranging from silver to zinc die castings.

Perhaps you would like to check Redline's cost/performance ratio in your own buffing operation? We suggest that you ask your buff supplier to prepare a test lot of buffs made with Redline cloth in the size and design you need. In this way you can check Redline yourself to see how it can improve your buffing performance.

Redline is a trademarked fabric. Together with Types 160, 190 and Wearon, it comprises the Milliken line of "Fabrics Engineered for Buffs".

DEEBING, MILLIKEN & CO., INC.
1045 SIXTH AVENUE • NEW YORK 18, N.Y.

Manufacturers' Literature

Abrasive Finishing of Brass and Bronze

Lea Mfg. Co., Dept. MF, 16 Cherry Ave., Waterbury 20, Conn.

This new sheet covers the abrasive finishing of brass and bronze. Instructions are applicable to all forms including extrusions, stampings, castings, spinnings and die castings. The sheet gives complete data on wheel heading, lubrication, surface speed and recommended types of buffs.

Finishing Systems

DeVilbiss Co., Dept. MF, Toledo 1, Ohio.

An illustrated index of the complete finishing systems available from above manufacturer, Form F-325 describes the various units and tells how to obtain additional information on each item.

Decorative Gold Plating

Sel-Rex Corp., Dept. MF, Nutley 10, N. J.

A 7-page technical paper covers metallurgical properties and applications for low pH acid-type gold plating formulations, trademarked Karatclad.

Essentially a technical exposition

brought up-to-date on properties, uses and data on both maintenance, composition, dragout control, the new booklet features a new section on colors, precise color control methods, color measurement, light sources and their effects. It describes colors obtained from each gold formulation, shows how to pick out and maintain customer-preferred shade.

Full details include metal content chart and guide to determination of gold, cobalt, nickel, and indium.

Buffing

American Buff Co., Dept. MF, 2414 S. La Salle St., Chicago 16, Ill.

The above firm has issued, in reprint form, the article entitled, "Better Buffing Through Better Buff Design" which appeared in the June and July 1959 issues of METAL FINISHING. It deals with conventional, puckered, centerless, sisal and unit or spoke buffs, as well as buff treatments and buffing operations.

Ultrasonic Cleaning

Oakite Products, Inc., Dept. MF, 118 Rector St., New York 6, N. Y.

Based on extensive field work with this fast-spreading cleaning method, Bulletin No. 16A describes the process by which high frequency sound waves impart intense scrubbing action to solutions to speed precision cleaning. The method's success, however, depends in large measure on the cleaning solution, according to the bulletin, which then describes compounds which have proved effective, and the types of operation ultrasonic cleaning does best.

Shot Peening

Perfecto-Peен Div., Aero-Test Equip. Co., Dept. MF, P.O. Box 10627, Dallas 7, Tex.

Bulletin PPD-109 describes the new Model A-50 machine for peening, cleaning and finishing by a patented process using specially-treated minute glass beads. Machine specifications are listed together with installation requirements and a cut-away view showing arrangement of components.

Electropolishing

MacDermid Inc., Dept. MF, Waterbury, Conn.

Metex Electropolish solutions used to produce brilliant finishes are described in Technical Data Sheets No. 42 on solid nickel or electrodeposited

nickel and some nickel alloys, and in No. 95 on steel and stainless steel.

Powdered Pickling Compounds

Frederick Gumm Chem. Co., Dept. MF, 538 Forest St., Kearny, N. J.

A 4-page technical bulletin contains information on powdered pickling compounds for various applications.

The bulletin describes the advantages of powdered pickling compounds, then cites a number of specific pickling problems with the compound recommended for each, together with a description of the compound. Description includes recommended working temperatures, concentrations used and length of treatment time.

Polyvinyl Chloride Solvent

Industrial and Biochemicals Dept. MF, E. I. du Pont de Nemours and Co., Wilmington 98, Del.

A new bulletin summarizes the latest laboratory data on the use of dimethylformamide (DMF) as a PVC resin solvent. The information will be of particular value to companies manufacturing protective coating formulations.

Plastic Coating Process

Michigan Chrome and Chem. Co., Dept. MF, 8615 Grinnell Ave., Detroit 13, Mich.

A six page brochure describes the new Micron process for the application of plastic resins in a fluidized bed. This brochure is available to readers on request.

Surfactants and Detergents

Swift & Co., Soap Dept., Dept. MF, Chicago 9, Ill.

A new 24-page bulletin describes the "Solar" line of synthetic surface active agents and detergents for industry, including various forms of liquid concentrates for wetting, emulsification, suspension, dispersion, etc., and solid materials for use as detergents, wetting agents, emulsifiers, etc.

The bulletin gives chemical and application specifications for over ten materials.

Water and Waste Treating

Infilco, Inc., Dept. MF, Tucson, Ariz.

An 8-page bulletin listing and describing custom designed process water and waste treating equipment outlines applications and features of 22 cate-

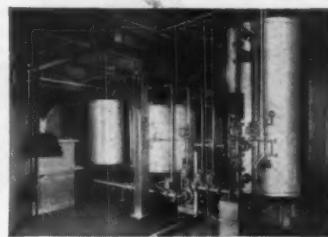
ionXchange

DO YOU WANT TO SAVE MONEY?

Here is how to solve some waste disposal problems -and reduce costs at the same time

IonXchangers of several types, and various units of allied equipment, as designed and manufactured by Illinois Water Treatment Company, offer a number of money-saving opportunities. For example, consider the waste water from rinse tanks. Contaminants can be removed and concentrated, and pure water returned to the rinse system. In some instances, chrome and other valuable metals can be recovered from the rinse water. For another example, consider plating solutions which, under many circumstances, become polluted and less efficient. The contaminating materials can be removed, recovered if valuable, and the bath maintained at high purity. Also, impurities found in water supplies, to spoil the appearance

of plated or anodized parts, can be removed so that uniform quality of work is assured. Spent metal finishing solutions such as aluminum bright dip can be purified for re-use. Toxicity in otherwise-clean waste can be eliminated. All of these treatments will, in one way or another, contribute substantially to improved products, more efficient operations, and lowered costs. Specific possibilities of applications of ionX-change in your plant can be determined by talking to your ILLCO-WAY representative.



IonXchanger recovery unit for plating solutions

**ILLINOIS WATER
TREATMENT CO.
840 CEDAR ST.,
ROCKFORD, ILLINOIS**

NEW YORK OFFICE: 141 E. 44th St., New York 17, N.Y.
CANADIAN DIST.: Pumps & Softeners, Ltd., London, Can.

ILLCO-WAY

Printed Circuits Plating

Sel-Rex Corp., Dept. MF, Nutley 10, N. J.

Starting with the specific application and intended service of the printed circuit, this 4-page article recommends ways and means to improve in-service reliability through latest developments in printed circuits plating technology. The precious metals, and various base metals, are covered in detail with their advantages and disadvantages for specific applications. Some of the problems discussed, and to which practical solutions are offered, include: lifting or peeling of the copper foil after the circuit has been placed in service; deformation of the di-electric base ma-

gories of equipment available for operations which use ion exchange, chemical feeding, leaching, oxidation, carbonization, purification and clarification.

Oven Catalog

The Despatch Oven Co., Dept. MF, 619 S.E. 8th St., Minneapolis 14, Minn.

The above firm has recently completed a reference catalog which gives basic information about laboratory ovens, pilot plant ovens and small batch type production ovens.

Complete oven information concerning each application is provided in specialized bulletins contained in each section, with ready reference tabs for locating applications.

**COPPER SULFATE
NICKEL SULFATE
FROM
PHELPS DODGE**

give you standard purity, uniformity,
solubility...plus:

YOU
ARE
DEALING WITH
A NAME YOU KNOW

Phelps Dodge, with over 60
years experience in supplying
the plating field, is a
dependable source of supply.

YOUR
ORDERS
ARE
PACKED
TO SUIT

INVENTORYING DEMANDS
...shipped to you in 100-lb.
sacks, and fibreboard drums,
the way it is easiest
for you to handle.

PHELPS
DODGE
IS ALSO
A PRODUCER
OF
SELENIUM AND TELLURIUM

THERE'S NEVER
A WAIT FOR SHIPMENT

Orders are filled
promptly from ready-
to-ship stocks.

PHELPS DODGE REFINING CORP.

300 PARK AVENUE, NEW YORK 22, NEW YORK



terial; softening of the adhesive or resin binder between copper foil and laminate; and lifting of the electroplated foil due to high tensile stresses.

A table gives recommended thicknesses of electroplate of various base and precious metals, predicated by the application of the printed circuit.

Vibrating Finisher

*Lord Chem. Corp., Dept. MF, 2058
South Queen St., York, Pa.*

Bulletin No. 1016E describes new 3-hp Model 1016E vibrator for precision finishing of metal, plastic or wooden parts. The four-page, letter-head-size bulletin gives general information, construction features and de-

tailed specifications, including standard equipment.

Protective Clothing

*Mine Safety Appliances Co., Dept.
MF, 201 N. Braddock Ave., Pittsburgh
8, Pa.*

A broad line of rainwear and protective clothing, designed for industrial, utility, and special applications, is described in a 12-page brochure, Bulletin No. 1312-2, which provides details and illustrations on a wide variety of suits, coats, pants, aprons, hats, and other accessories.

Specifications are provided for individual items, including recommended areas of application, resistance char-

acteristics, sizes, and colors. Instructions for care and cleaning of neoprene latex clothing are also given.

Flexible Shaft Equipment

*Wyzenbeek & Staff, Inc., Dept. MF,
223 N. California Ave., Chicago 12,
Ill.*

A new eight page catalog of flexible shaft equipment and other labor saving Wyco tools is just off the press. Several new vari-speed and transformer type variable speed flexible shaft grinders are listed. Ask for Catalog No. 59.

Brass Electropolish

MacDermid, Inc., Dept. MF, Waterbury, Conn.

Metex Electropolish BB, an acidic solution used to produce a brilliant luster on lead-free wrought brass, is fully described in Technical Data Sheet No. 41, a two-page usage and instruction sheet.

Colored Organic Finishes

*Bee Chem. Co., Logo Div., Dept.
MF, 12933 So. Stony Island Ave.,
Chicago 33, Ill.*

Bronzeless gold spray finishes which provide an appearance comparable to coatings made with bronze powder are discussed in an 8-page booklet just published. Chips displaying the standard colors are shown in the booklet.

BUSINESS ITEMS

Chromium Plating Pioneer Retires

J. Merle Hosdowich has retired after 35 years' service with *Metal & Thermit Corp.* He joined the company in 1923 to do research and development work on chromium plating. Prior to this, he was a research Fellow at Mellon Institute in Pittsburgh. He received the B. S. Degree in Mechanical Engineering from Carnegie Institute of Technology.

In the late 1920's, Mr. Hosdowich became chief chemist and laboratory manager of United Chromium Corp., now an M&T subsidiary. Since 1940, he has served in various technical and advisory capacities with the corporation in New York and Rahway.

The author of numerous technical papers and articles on chromium plating, Mr. Hosdowich also has been a



J. H. Hosdowich (left) being presented with electric portable typewriter by H. D. McLeese, vice president of M&T.

frequent speaker before professional and technical societies.

Until his retirement, he and his wife lived in Scotch Plains, New Jersey. They plan now to settle in Tucson, Arizona, where a daughter, Mrs. Joan McCarter, teaches mathematics at the University of Arizona.

Belke Appoints Distributor

Appointment of Keystone Plating Supplies of Hazel Park, Mich., as exclusive distributors for a complete line of plating equipment in the Michigan Territory is announced by Belke Mfg. Co., 947 N. Cicero Ave., Chicago 51, Ill.

Sel-Rex Licenses Wildberg Bros.

Wildberg Bros. Smelting & Refining Co., San Francisco and Los Angeles, Calif., has been licensed to manufacture and sell alkaline and acid gold plating formulations covered by various Sel-Rex Corp. patents, it has been announced jointly by both companies. It is reported that Wildberg Bros. will announce shortly their offering of several new gold plating processes, as well as the continued availability of Wilbro 'Bright Gold,' operating under this licensing agreement.

Walter T. Haley, Wildberg vice president and general manager, reports that technical personnel from his company have already completed a thorough training program at the Sel-Rex laboratories in Nutley, N. J., so they may better serve the requirements of their customers for the newly licensed products.

According to Morris M. Messing,

president of Sex-Rex, the licensing agreement does not affect the operation of their West Coast Office.

Moyer Joins Wyandotte Chemicals Corp.

Marvin R. Moyer has joined the Industrial Department of Wyandotte Chemicals Corp. as a product-service representative. He will work out of the J. F. Ford Division's Philadelphia, Pa. office.

Mr. Moyer's eight-year industrial background includes process engineering work; metal cleaning and finishing, and electroplating. He is an experienced production supervisor and his earlier experience was as a laboratory technician.

Mr. Moyer is a member of the American Chemical Society (A.C.S.) and makes his home in Berwick, Pa.

Guiltinan Joins H-VW-M

Hanson-Van Winkle-Munning Co. has announced the appointment of Walter C. Guiltinan as sales representative in the Pittsburgh and Western Pennsylvania areas.

Upon graduation from Notre Dame in 1953, Mr. Guiltinan joined the sales



Walter C. Guiltinan

force of a leading metal finishing supplies distributor. He remained with this organization until joining H-VW-M.

Mr. Guiltinan, 34, served in the United States Navy during World War II and holds medals from all three theatres. After the war he was employed by a large manufacturer as a time, motion study and products control expert.

Guiltinan reports to Calvin E. A.

STUTZ

**BALL
ANODE
CONTAINER**

STUTZ **CONVENTIONAL**

New Construction
for longer Service ...

STUTZ
CONSTRUCTION

Heavy gauge steel with wire woven through steel angle firmly attached to main stem. Cannot come apart or loosen. Side clip is for STUTZ BARREL PLATING TANKS having submerged rectangular anode bars. Side clip not furnished for racked plating tanks. Standard hook 6 inches. Other hook lengths available, however deliveries could be delayed.

WELDED CONSTRUCTION — Note how welds have dissolved or broken in use. Often caused in barrel plating where currents are high and barrel transfer is rapid.

Write for Complete Literature

The
STUTZ Company
4430 Carroll Ave. • Chicago 24, Ill.

Complete Metal Finishing
Equipment & Supplies

Solla, district manager at Cleveland. His office will be in Pittsburgh.

Carborundum Personnel Appointments

The Carborundum Co.'s Bonded Abrasives Division has announced a series of promotions effective January 1, 1960.

P. R. Junod, salesman in the Buffalo district, will become Philadelphia district sales manager.

E. A. Japely, salesman in the San Francisco district, will become sales manager of Area "A", Chicago District.

M. M. Craft, presently field sales engineer in Los Angeles, will become sales manager of the Los Angeles sales district.

F. J. Blake will continue as sales manager of the San Francisco district. In addition, Mr. Blake will be responsible for Bonded, Coated, Electro Minerals and Merchandising Division sales in Alaska and Hawaii.

After 33 years of service **F. C. Guest**, Detroit district sales manager, retired and is succeeded by **K. H. Wisby**, formerly assistant sales manager of the Detroit district.

Michigan Chrome Appoints Harper

Michigan Chrome & Chem. Co., Detroit, Mich., announces the appointment of **Paul D. Harper** as west coast district manager, Chemical Division.

Harper is a graduate engineer and has had twenty years of supervisory experience in the metal finishing industry.



Paul D. Harper



Horace F. McIntyre

try. He was plant manager of the company's Plating and Coating Divisions for several years prior to moving to the west coast as a representative for a leading precious metal solution manufacturer.

In his new assignment, Harper will be responsible for technical sales of plastisols, coatings for the electroplating industry and fluidized-bed resins. His territory incorporates the three west coast states plus Arizona.

Pennsalt Inaugurates Direct-To-Consumer Sales

Pennsalt Chemicals Corp. has announced that it is now selling its nationally-known line of metal processing products on a direct-to-consumer basis in New England.

Heading the new metal processing

service team in New England will be **Horace F. McIntyre**, Eastern district sales manager. McIntyre, a veteran of 16 years' sales and service with the Metal Processing Department, will devote a major part of his time in New England to assist in the transition to the direct-to-consumer service.

Representatives who will serve customers in New England are **Marshall J. Welch** and **Gordon E. Baker**. Welch, formerly a process engineer with the General Electric Co., will work out of headquarters in Vernon, Conn. Baker,



Gordon E. Baker

DEPENDABLE

PPJ

PRODUCTS

- RUBBER AND PLASTIC DRUM LINERS
- MONEL, STEEL, COPPER AND TITANIUM ANODE HOODS
- PLASTIC COATED PAILS AND DIPPERS
- POLYETHYLENE TANKS AND PAILS
- TITANIUM ANODE SCAFFOLDING BASKETS
- TITANIUM HEATING COILS
- TRICHLOROETHYLENE
- PERCHLOROETHYLENE
- SILVER BRIGHTNER
- SWIMMING POOL CHEMICALS
- OIL ABSORBENT
- ACID TANKS AND CONTAINERS
- HAND CHEMICAL PUMPS

LIGHTWEIGHT • LONG LASTING • STURDY POLYETHYLENE TANKS ... Non-Breakable Cylindrical and Rectangular — External Flange Tanks — Molded in One Piece ... without seams

• Do Not Get Brittle with Age • Safer for Employees • Cheaper Than Stainless Steel Tanks or Rubber Lined Drums

Can safely be used with the following solutions at a temperature of 122° F.
ACIDS: Acetic 10%, Chromic 10%, Hydrochloric 50%, Hydrofluoric 50%, Nitric 10%, and Sulfuric 70%
Sodium Hydroxide 50% • Hydrogen Peroxide 30%

Cylindrical Tanks — External Curled Cuff Flange — Straight Sides

Stock No.	Gal.	Gal.	Out. Dia.	Height	Remarks	Price	Cylindrical Tanks will fit as inserts into standard 15, 30 and 55 gallon steel drums ...
CK1522	15	15	15 ins.	22 ins.	Self Supporting	\$18.50	
CK1528	30	30	18 ins.	29 ins.	Self Supporting	23.75	
CK2235	55	22½ ins.	34½ ins.	Self Supporting	26.00		



Rectangular Tanks — External Flange — Straight Sides — Heavy Wall

Stock No.	Gal.	Length	Width	Height	Remarks	Price
RX281525	52	22½ ins.	10½ ins.	35½ ins.	Need Support	\$111.75
RX281536	52	22½ ins.	14½ ins.	35½ ins.	Need Support	111.75
RX481523	66	47½ ins.	14½ ins.	23 ins.	Need Support	119.25
RX282636	101	25½ ins.	25½ ins.	35½ ins.	Need Support	131.25
RX471629	104	47 ins.	17½ ins.	29½ ins.	Need Support	150.00



PLATING PRODUCTS, Inc.

1509 N. WASHINGTON
KOKOMO, INDIANA

a representative for the past two years in New England, will cover the industrial counties of Fairfield and New Haven in Connecticut from headquarters in New York.

Other seasoned metal processing specialists who will assist field representatives are **Philip C. Rech**, industry manager; **Neil E. DeBranch**, manager



Marshall J. Welch

of aviation sales; and *Stanford J. Barlett*, manager of equipment sales.

**Cunningham Appointed
District Sales Manager
for Kelite Corp.**

W. Douglas Cunningham has been appointed district sales manager for *Kelite Corp.*, manufacturer of metal finishing and industrial maintenance chemicals and equipment.

Mr. Cunningham will be responsible for sales in the Dallas, Texas, district of the western sales region. His headquarters will be at the Dallas facility.



W. Douglas Cunningham

Mr. Cunningham has been a sales engineer with the firm for the past 8 years.

**Oakite Names Rohlfsen
Manager of Division**

T. A. Rohlfsen, of Sherman Oaks, has been appointed manager of the South Pacific Coast Division of *Oakite*



T. A. Rohlfsen

Products, Inc., pioneer manufacturers of specialized chemical compounds for industrial cleaning and metal treating. He succeeds *J. C. Leonard*, who is retiring after 35 years of service with the company.

**Stevens Opens New
Warehouse and Office**

Official opening of a new Indianapolis, Ind., warehouse and office for *Frederic B. Stevens, Inc.*, took place on Nov. 5-6 at a two-day open house for local businessmen in the foundry and metal finishing industries. The new location is at 5345 Lexington Ave., moved from 4000 East 16th St.

Personnel at the new location will remain the same, with *Vincent Bruce* and *Gene Conreaux* representing the Foundry Department and *Roman Bender* representing the Metal Finishing Department.

Schulze Joins Hooker

Appointment of *Arthur P. Schulze*, of Cleveland, Ohio, to the public relations department of *Hooker Chemical Corp.*, Niagara Falls, N. Y., is announced by *R. Wolcott Hooker*, senior vice president. He will be engaged in all phases of the company's broadening corporate public relations program, reporting to *Thomas H. Trimble*, manager of public relations.

Mr. Schulze comes to Hooker from Diamond Alkali Co., Cleveland, where he was manager of public relations and advertising for nearly five years. Previously, from 1947 to 1954, he was associated with Hill and Knowlton of Cleveland, public relations counselors. At one time a newspaper reporter, his earlier experience also includes ten

for
**EXTRA
BRIGHT
FINISHES**
on
DIE CASTINGS
NOTHING
COMPARES
with
BUFFING
and
THE BEST
Buffing
COMPOSITIONS
are from
STEVENS

for your die castings
we recommend . . .

44-L
LIQUID TRIPOLI

48
BAR TRIPOLI



Write for
your copy of
Stevens' new
folder on liquid buffing
and coloring compositions

FREDERIC B.
STEVENS
INCORPORATED
DETROIT 16, MICHIGAN

years in publicity and sales promotion work.

A 1936 journalism graduate of the University of Missouri, Mr. Schulze is a member of the Public Relations Society of America and a past director and officer of its Northeast Ohio Chapter. He also belongs to Sigma Delta Chi, professional journalism fraternity.

With his wife and three children, he plans to establish residence in the Niagara Falls area in the near future.

Eichelman Appointed Alkyl Chemicals Representative

Alkyl Chemicals, Inc., formulators of industrial chemical specialities, has announced the appointment of *William H. Eichelman & Associates* of Pontiac, Mich., as representatives for Michigan and Ohio, for a complete line of liquid ferrous and non-ferrous metal cleaners, rust inhibitors and anti-rust lubricants as well as products for the plastics industry.

Nugent to Represent Heatbath

Heatbath Corp. announces the appointment of *Thomas Nugent* as technical sales representative for upper



Thomas Nugent

New York State. Mr. Nugent has had extensive experience in the heat treating and metal finishing field, and will have headquarters at 33 Mechanic St., Jordan, N. Y.

Bernard Lindstrom, formerly technical sales representative in this area, has been transferred to the Eastern New England area where he will represent

sent the firm in the same capacity. Mr. Lindstrom will have headquarters in Springfield, Mass.

Appointments at Consolidated Vacuum

Appointments of *Howard C. Jones* as assistant to the president and *Malvern J. Gross* as director of manufacturing, *Consolidated Vacuum Corp.*, were announced recently.

Jones joined the company in 1955 as director of manufacturing and has continued in that position to the present. He served 8 years as works manager of the Delco Appliance Div., General Motors Corp. Previous to this he held various engineering capacities as equipment engineer, plant engineer and chief engineer for the North East Electric Co. and its successor, Delco. He holds a mechanical engineer degree from Cornell University.

In his new post Gross will be responsible for all phases of manufacturing from purchasing through final assembly and shipping. He was associated with General Electric in various manufacturing and engineering

for the
"Solution to
your Plating
Problems"
... come to



— for the Brightest Copper ever . . . right out of the barrel!

BARREL COPPER Brightener . . . can be used in

your present regular solution with standard equipment

- The only ONE brightener required — cuts operating costs
- Tops in throwing power — produces complete coverage immediately
- Doubles your plating rate — increases production
- Eliminates cyanide fumes

A Proven Process!

Used successfully
by job platers
and manufacturers

NON-CRITICAL
BOOSTS PRODUCTION
CUTS REJECTS

For technical
information,
complete details
and prices
... write to



Finishing Equipment Corp.

153 East 26th Street, New York 10 • Phone LExington 2-3055

capacities from 1928 to 1954. He became director of engineering in 1954 for the Ritter Co., Inc., Rochester, N. Y., and served in that position until he became vice-president for manufacturing of Tracerlab, Inc. and general manager of that organization's wholly-owned subsidiary, Keleket X-Ray Corp., from 1956 until joining Consolidated.

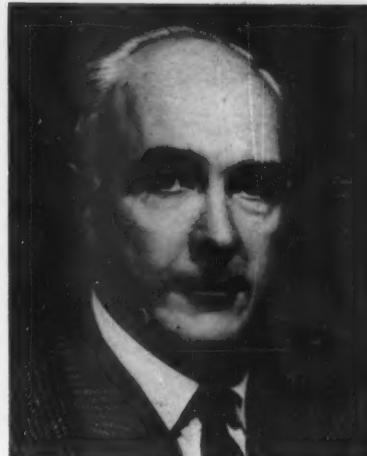
Gross, a graduate of Oregon State College with a B.S. in electrical engineering and Union College with an M.S. in physics, is a registered professional electrical engineer.

Bell Appointed by Sole Chemical

Sole Chemical Corporation, Chicago based surfactant producer, announces the appointment of *Jack H. Bell* to the technical sales staff, covering the Minnesota, Wisconsin, Michigan, Illinois, and Indiana area. Mr. Bell, for the previous 9 years, was in the research and technical sales departments of Emulsol Chem. Co.

Riegel Advances Miller

William J. Miller has been appointed



William J. Miller

manager of sales and production for the Bias Buff Division, *Riegel Textile Corp.*, at Conover, N. C. Mr. Miller has been with the Buff Division in various capacities since he joined the organization in 1939. Riegel's buff production facilities were recently transferred to Conover, N. C. from Jersey City, N. J.

Hooker to Establish Headquarters in New York

The board of directors of *Hooker Chemical Corp.* has voted to establish corporate headquarters in New York City some months hence. The decision involves only some fifteen to twenty people in certain corporate departments out of approximately 461 corporate personnel and a total of about 2550 employed by the company at Niagara Falls.

Many corporate functions which can be performed more effectively at Niagara Falls will continue to be handled there entirely. For example, some 335 persons employed in the central research and central engineering departments will continue undisturbed. The corporate accounting, general development, and traffic departments and others will also remain.

The firm has signed a lease agreement for office space at 666 Fifth Ave., New York City, in a new building completed less than two years ago. It has rented the entire 34th floor, heretofore unoccupied. This will also accommodate the company's New York District sales offices now in the Lincoln

THE NEW 303 IS



NEW MODEL 303

New single roll table type in four sizes. Hydraulic travel: in, out and sidewise. Delicate automatic counter-balancing assures sensitive floating action for flat or contoured surfaces. Quick-Change spindle. Max. floor space: 6' - 10" wide x 10' - 7" deep. Wt. approx. 6,000 lbs. Model 303 can be shipped assembled. Let us know YOUR requirements.

CLAIR

MANUFACTURING CO., Inc., OLEAN, N.Y.

Offering the Most VERSATILE Line of Surface Finishing Machines

NUGLU

THE IDEAL ADHESIVE

For Setting Up or Recoating Polishing Wheels, Abrasive Belts & Discs

Nuglu, a liquid glue, developed to lengthen wheel life — produce a better finish, and increase metal finishing production.

BRUSHING NUGLU

A mixture of Nuglu and graded aluminum oxide grain —

Save on operating costs, increase production, reduce wheel inventories, and obtain greater results, with less costly materials, in fine polishing work!

Ask for information on The J. J. Siefen Finishing Systems — Also for better metal finishing use J. J. Siefen Compositions • Stainless Steel • Bar (Grease) in Tube • Liquid Tripoli • Liquid Grease • Lapping Compound • Burring Compound.

J. J. SIEFEN FOR SERVICE

J. J. SIEFEN CO.

5643 LAUDERDALE, DETROIT, MICH.

*1927

Our Thirty-Second Year

1959*

Building, 60 E. 42nd St. The new offices should be ready for occupancy in late February or March 1960.

Australian Electroplating Shows Rapid Growth

The rate of growth of electroplating "down under" is out-pacing the United States, according to Peter L. Berkelaar, technical sales representative, *United Chromium (Aust.) Pty., Ltd.*, Sydney, who is spending a month in this country being brought up to date on the latest technical developments in both electroplating and organic coatings. Mr. Berkelaar estimates that Australian electroplating activity has more than doubled since World War II, and should double again within the next ten years.

Australian plating practices are practically identical to those in the United States, Mr. Berkelaar pointed out. He attributes this to the excellent transmission of technical and application information from this country. The main difference is that production runs "down under" are far smaller than in the U.S., meaning less automation of plating equipment. And, he



Peter Berkelaar (left), technical sales representative, *United Chromium (Aust.) Pty., Ltd.*, Sydney, Australia, and R. W. Couch (right), Metal & Thermit Corporation

added, "it's difficult to compare the U. S. automobile industry—traditionally the biggest user of chromium plating solutions—with its Australian counterpart: we use chromium plate primarily for decorative and corrosion-resistant purposes. Die castings, hardware, tubular furniture, domestic appliances, and general decorative appli-

cations are the big market," he said.

Mr. Berkelaar, a native of Holland, who studied Chemical Engineering at M.T.S. in Utrecht, has been a guest of *Metal & Thermit Corp.*'s electrochemical division in Detroit.

Armour Appoints New Abrasive Salesman

Thomas R. Wiggins has been appointed a sales representative, Coated Abrasives Division, *Armour Alliance Industries*, Alliance, Ohio. Mr. Wiggins will service customers in Southern Michigan and Northwestern Ohio.

Prior to becoming associated with Armour, he was a sales engineer with another abrasive company. He served in the U. S. Army Air Corps as a second lieutenant from 1943 to 1945. Mr. Wiggins is a native of Owosso, Mich., and attended public schools in Owosso and Michigan State University.

Archie J. MacDermid Disposes of Stock in MacDermid Inc.

Archie J. MacDermid, prominent Waterbury industrialist, recently sold controlling interest in *MacDermid Inc.*, developer and manufacturer of metal finishing chemicals. Under terms of

- High Count, Heavy Duty, Bias-cut Cloth.
- Extra folds provide wider buff face and greater compound holding capacity.
- Ventilated Steel Centers.
- Perfectly balanced sections require no raking.

FORMAX BUFFS—These famous fast cutting and long wearing buffs continue to set the standard of performance for bias-type cloth buffs. You can depend on uniform quality from shipment to shipment.

Write for Descriptive Literature

FORMAX MFG. CORP.
DETROIT 7, MICHIGAN
"THE FOUR MC ALEERS"

NEW!
defies chemical attack, heat
"in tank" PUMP
and outside FILTER
with detachable
FILTER CHAMBER
Model UAL-20 200-300 Gals./Hr.
other models from 50-1200 Gals./Hr.
Compact, takes little space in tank

It's corrosion proof . . . handles all acids and alkaline solutions up to 250°. Self-priming, leakproof EPOXY sump pump provides continuous duty performance. Bracketed inside the tank, it requires no floor space. Outside bracket supports High Temp. Lucite or Epoxy filter chamber . . . 1/2 or 3/4 HP motor. Pump and filter chambers are available separately.

For complete details: WRITE for Spec. Sheet No. 751B

Sethco
MANUFACTURING CORP.

NEW Illustrated 8 page Brochure,
BULLETIN M-1. Complete catalog of Sethco Filters from 50 to 2700 Gals./Hr.

MAYfair 3-4220 • 2286 Babylon T'p'ke, Merrick, L.I., N.Y.

the \$1,500,000 transaction, representing 31% of the outstanding stock, MacDermid sold 16,240 shares to 55 employees. His remaining holdings of 29,000 shares were purchased by the company. Eighty per cent of the employees now own 72% of the voting stock.

Mr. MacDermid resigned as board chairman and director, and will retire. In addition to *Harold Leever*, president, other officers and directors, who remain the same are: *Stanley S. Krentel*, Detroit, executive vice president; *Thomas A. Downie*, vice president and secretary; *Arthur R. McNeil*, vice president and New England sales manager; *J. Douglas Lunan*, treasurer; and *John A. Hawksley*, general superintendent.

Abbott Ball Names Berges

Emil H. Berges, Jr., has been named marketing manager for *The Abbott Ball Co.*, West Hartford, Conn.

A native of Connecticut and currently a resident of New Haven, Berges was graduated from Brown University in 1949 with a degree in economics. From 1950 until joining Abbott, he had



Emil H. Berges, Jr.

served the Hinde & Dauche division of West Virginia Pulp and Paper as district sales manager for their Meriden plant.

Nalco Chemical Co. Announces Promotions

Nalco Chemical Co., Chicago, manufacturer of industrial chemicals, has appointed *James E. Starry* district

manager for its Texas district, with headquarters at Houston. He succeeds *William H. Rodewald* who recently was named vice president and general manager of the subsidiary in Venezuela.

Starry has been with the company since 1948. Most recently he was product manager of the coagulation chemical department of the industrial division in Chicago. Earlier he was a field representative and area manager in the Indiana district.

John T. Burke has been promoted from area manager in the Pittsburgh district to *Starry's* former post. He has been with the firm since 1948, serving as field and district representative before being named area manager in Pittsburgh.

M&T Forms International Division; Constructs Plant in Mexico

Establishment of a new International Division to increase the rate of growth of *Metal & Thermit Corp.*'s operations overseas was announced recently. Simultaneously announced

LEA GRIPMASTER®

Industry's Abrasive

BONDING CEMENT
for Wheels and Belts

SIZES AS WELL AS BONDS

Gripmaster cuts out one preparation material and one preparation step. No special sizing is necessary. This superior bonding cement has a double use. But seein' is believin'. Test Gripmaster in your own plant under your own working conditions. Send us the enclosed coupon or use your company stationery and we'll send you a test size sample without charge or obligation.

LEA-MICHIGAN, INC.

14459 Wildemere, Detroit 38, Michigan

(A member of the well-known Lea Group of Finishing Specialists)



Lea-Michigan, Inc. 14459 Wildemere Detroit 38, Mich.	<input type="checkbox"/> Please send us your free sample of GRIPMASTER. <input type="checkbox"/> Please send us literature giving full details.
Name _____	Title _____
Company _____	MF- 12-58
Address _____	

AGATEEN!

Our
Compliments
of
The Season

AGATE LACQUER MANUFACTURING CO., INC.

SERVING INDUSTRY SINCE 1927

11-13 43rd Road
Long Island City, N. Y.
Stilwell 4-0660 - 1

AGATEEN!
THE LAST WORD IN QUALITY

was construction of a manufacturing facility in Mexico.

The new division will be headed by *Charles H. Carpenter, Jr.*, as general manager. He was formerly manager of the company's Commercial Development Division.

The new division will consolidate responsibility for company operations and sales in foreign countries. It also will handle licensing and patent agreements, and will provide liaison with foreign subsidiaries and affiliates, with the exception of Canadian interests and Australian mining operations.

The new Mexican plant, to be located in Monterrey, will produce ceramic chemicals. It will be operated by a new subsidiary, Industrias M&T De Mexico, S. A., De C. V., owned jointly by M&T and by a group of prominent Mexican industrialists headed by *Jose T. Mata*, who is president of the new company. He also is managing director of Productos de Zinc Y Plomo, S. A., De C. V.

The principal products will be ceramic opacifiers, materials used primarily in the manufacture of ceramic wall tile and sanitary ware.

Chalfant Promoted by Kelite

Charles N. Chalfant has been promoted to senior product manager—metal finishing by *Kelite Corp.*, manufacturer of metal cleaning and processing chemicals, industrial maintenance chemicals, and equipment. For the past year, he has been product manager—metal finishing, in which position he

has been responsible for the development of metal finishing sales in the eastern and midwestern sales regions. In his new position, Mr. Chalfant will continue his field responsibilities. In addition, he will have a new staff function in providing training and liaison with other product managers.

Mr. Chalfant has been active in laboratory and sales work in the metal finishing industry for more than 30 years. He majored in chemistry at Carnegie Tech, and is a member of the A.E.S. He will continue to make his headquarters at the firm's Berkeley Heights, N. J. facility.

Free Course in Electroplating

The course of study in electroplating given at the Fort Greene Evening High School, 29 Fort Greene Place, Brooklyn, N. Y. (formerly Brooklyn Evening Technical High School) will begin its Spring term on February 2, 1960.

The session is divided into classroom discussion and laboratory experiments. The classroom topics will include simple calculation, reading graphs, chemistry of the plating tank,



Charles N. Chalfant

A **UNIVERTICAL**
N High Purity
D
E
S

● Be Ahead Of The Rest
GET THE BEST!

●
You Can Be Sure Of
QUALITY
SERVICE
and VALUE

Virgin Metals Used Exclusively



UNIVERTICAL CORPORATION
14841 Meyers Rd., Detroit 27, Mich. • BBroadway 3-2000

A
N
D
E
S

Automatic Compound Applicators



Nankervis Automatic Compound Applicators have been the first choice with metal finishers for over 15 years because they are reliable, lightweight, inexpensive and available in a variety of models to suit all requirements. Write for descriptive literature on the complete line of Nankervis Applicators today. *George L. Nankervis Company, 15300 Fullerton, Detroit 27, Michigan.*

Write for
Bulletin No. 600



GEORGE L. NANKERVIS CO.

Representatives in Principal Cities

pH, wetting agents, pitting, deionizing. The laboratory experiments will include solution analysis, Hull cell studies, anodizing.

Registration begins January 25, 1960, and daily thereafter from 7:00 to 8:30 P.M. Classes will meet on Tuesday and Thursday from 6:45 to 8:15 P.M., including about 6 Fridays. The term begins February 2 and ends June 28, 1960. Register with Mr. L. Serota in Room BW17 or 3E12.

Micrometrical Mfg. Co. Erecting New Building

The new home of *Micrometrical Mfg. Co.* now under construction at 3621 South State Road, Ann Arbor, Mich., is designed to accommodate all manufacturing, engineering and research currently located in 5 separate buildings, bringing them together under one roof.

The modern one story building of brick, steel and glass construction will be completely air conditioned throughout and is being built at a cost of \$350,000. The building will have 30,000 square feet of floor space and will be located on a ten acre tract of land bordering the Detroit Expressway.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Hydrogen Embrittlement Symposium to be Featured at Los Angeles Convention

It has just been announced that an all day technical session on Wednesday, July 27th, will be devoted to this important subject including an evening round-table discussion.

Other sessions will include one on organic coating and many other phases of plating, cleaning and anodizing. The complete educational program will be announced in subsequent issues, but we can say at this time that 37 papers are tentatively scheduled. Dr. Harold J. Read, Professor of Physical Metallurgy, Pennsylvania State University, is in charge of the Hydrogen Embrittlement Symposium.

The convention will be housed in the large and relatively new Statler-



Tony Stabile
General Chairman

Hilton Hotel, centrally located on the edge of the downtown business district at the beginning of Wilshire Blvd.

July 24th to 28th are the days, and *Tony Stabile*, connected with the Associated Plating Co., 417 East 16th Street, Los Angeles 15, California, is the general chairman. His assistant is *George J. Hetz*, who is affiliated with



Chemical polishing cuts finishing costs

Alchemize is the preferred way to finish aluminum with any polish from satin to mirror. It is fast, costs little, needs no electricity—ideal for intricate shapes. See for yourself—we'll process your samples without charge. Write for complete data.

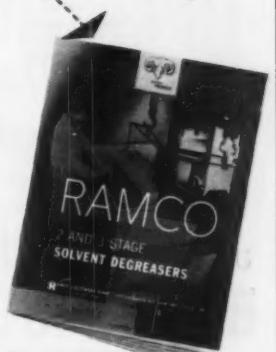
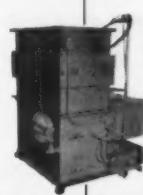


Alchemize Corporation, 625 S. Kolmar at Congress Expressway, Chicago 24, Ill.

metal parts cleaning problems?

Q
A

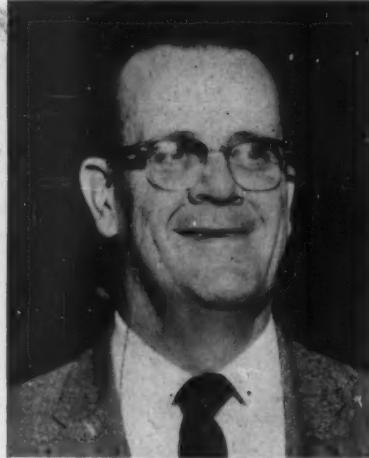
GET THE ANSWERS
RIGHT FROM
RAMCO'S NEW
BULLETIN!



Send for your copy
of the Ramco Bulletin. See how
Ramco 2- and 3-dip degreasers can
solve your metal parts cleaning
problems, safely, efficiently, eco-
nomically! Write today!

RAMCO EQUIPMENT CORP.

DIV. OF RANDALL MFG. CO., INC.
807 Edgewater Rd. • New York 39, N.Y.



George Hetz
Co-Chairman

C & W Metal Finishing, Inc., 3525 S. Greenwood Ave., Los Angeles. Both are job shop men in this city of 375 job plating establishments.

Being in Los Angeles, the social and ladies program will have more feature attractions than heretofore possible, including a visit to Disneyland.

Plans are now being formulated for groups of platers from the East and

Central States to travel together by air or train and announcements on the ways and means of getting to Los Angeles will appear in our January issue.

Phoenix Branch

At a properly impressive ceremony held at a dinner meeting at the Valley Ho Resort Hotel, Scottsdale, Ariz., Friday, Oct. 9, the Phoenix Branch was presented with its permanent charter. The installation team consisted of *Ralph D. Wysong*, Studebaker-Packard Corp., and president of the A.E.S., and *John P. Nichols*, executive secretary of the A.E.S.

Dr. Clyde Crowley, head of Chemistry Dept., Arizona State University, acted as master of ceremonies. Dr. Crowley introduced several noted guests including the following: *Governor and Mrs. Paul Fannin*; *Mayor and Mrs. Jack Williams*; *Dr. Merle C. Nutt*, head of Metallurgy Dept., A.S.U. Several out-of-state guests were present, including *Mr. and Mrs. Lawrence O'Neil*, L'Hommedieu & Sons Co., Los Angeles; and *Gene H. Weiner*, Shipley Co. Inc., Boston, Mass. It would not be possible to list all the



Left to right, standing: James Weaver, Sect.; Dean Hill, 3rd V. P.; John Mullarkey, Treas.; Paul Wible, Librarian; Paul Madden, Bd. of Mgrs.; Bob Axson, 2nd V. P.; Floyd Hubin, 1st V. P.; Dr. Clyde Crowley, Bd. of Mgrs. and toastmaster for the occasion. Seated: John P. Nichols, Exec. Sect. (National); Bill Griff, Pres., Phoenix Branch; Ralph D. Wysong, National Pres., A.E.S.

distinguished guests, especially since all of the one-hundred guests present could be so considered.

Mr. Nichols spoke on the value of the A.E.S. to industry, the member, and to society. Branch Secretary *James Weaver* gave the history of the formation of the branch, and *President William Griff* introduced the branch officers.

Brief speeches were given by Gov-

TAKE THE LOAD OFF YOUR TOP BRASS



USE TRUE BRITE BRASS SOLUTIONS

Trouble Free — Low Cost

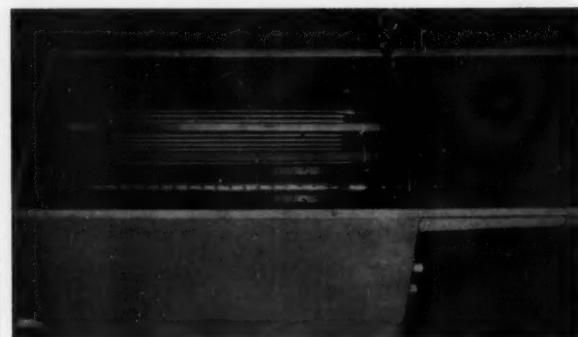
Little Supervision Needed

Ready To Use — Just Add Water

Uniform Color — Can Match Colors

Write For Bulletin on Brass Plating

TRUE BRITE CHEMICAL PRODUCTS CO.
BOX 31, OAKVILLE, CONN.



Design for Improvement

ANY FORM of improvement that is conceived or suggested for equipment units that are already at work can usually be incorporated into the next unit added, or the first replacement, often into present units . . . by Storts-welding. The dip and drain tank shown has been redesigned for greater efficiency. Welding by Storts has made it strong, leakproof and dependable. A wealth of experience in redesigning for improved production performance is at your disposal.

STORTS
WELDING COMPANY
INCORPORATED

38 Stone Street
MERIDEN, CONN.

Manufacturers of Welded Fabrications to Specification

ernor Fannin, Mayor Williams and Dr. Lester Hogan. The event concluded with dancing and festivities, with music by Frank Pratt and his combo.

New York Branch

The annual Educational Session of the New York Branch will be held on Saturday, February 6, 1960 at the Statler-Hilton Hotel in New York City.

The speakers for the technical session will be:

Dr. R. B. Saltonstall, The Udylite Corp., "The Role of Agitation in Plating."

Dr. J. G. Beach, Battelle Memorial Institute, "Plating on the Less Common Metals."

Ronald Dow, Metal & Thermit Corp., "Duplex Chromium Plating."

This year, while the men are attending the technical session, beginning at 2:00 p.m., the ladies are cordially invited to an afternoon of games. Many gifts have been selected, and it promises to be a fun-filled afternoon.

The dinner-dance is set for 7:00 p.m. at the Terrace Ballroom. Each year an excellent entertainment program is presented, which is enjoyed

by all. An announcement will be made in the near future regarding this year's program.

Aerospace Finishing Symposium

Planning jointly the first national finishing symposium on "Treatment and Finishes for Aircraft Materials," which was held December 7-9, are the

above members of the Southwest Society of Aircraft Materials and Process Engineers and Dallas-Fort Worth Branch, A.E.S. Left to right, seated, are *C. P. Waggoner*, *C. P. Waggoner Co.*, Grand Prairie; *Louis DeChellis*, Andrew Brown Co., Irving; *J. J. Pulaski*, Convair, Fort Worth; *Ray Goudeau*, Air Accessories, Fort Worth;



FAST STRIPPERS

(for Metal Parts)

Enamels • Lacquers • Primers • Vinyls • Synthetics

SEND FOR COMPLETE DATA AND FREE TEST SAMPLE

LEA SYNSTRIP . . . a fast working, non-corroding liquid, enamel, lacquer and synthetic coating stripper. Will not attack aluminum, zinc or any other base metal or alloy; does not dissolve the coating but breaks the bond. When heated to temperatures of 160° to 200°F., stripping synthetic coating of the alkyd, epoxy, phenolic, silicone and urea type, is accomplished in a matter of seconds.

— and —

LEA COLDSTRIP . . . high speed stripper used at room temperature; only minimum ventilation; can be filtered for continued use.

The LEA Manufacturing Co.

16 Cherry Avenue
Waterbury 20, Conn.

BEAM-KNODEL CO.

METROPOLITAN DISTRIBUTORS

HANSON-VAN WINKLE-MUNNING CO.



COMPLETE SERVICE FOR
PLATING AND METAL FINISHING

195 LAFAYETTE STREET NEW YORK 12, N. Y.
CAnal 6-3956 - 7

DOUBLE ACTION

drying speeds up production!

Model 20 New Holland

KREIDER

Centrifugal Dryer



Air-Dry, Spin-Dry action assures moisture-free surfaces in half the time! Eliminates scoring and marring, cuts down on rejects. Drying costs nose-dive!

SPECIFICATIONS:

1-h.p. motor— Quiet V-belt drive.
220, 440, 550 volts Arc-welded steel plate construction.
—2 or 3 phase. Spins 75-lb. loads Weight 490 lbs.
at 825 r.p.m. Requires mini-

mum floor space.
Meets N.E.C. specs.
Auxiliary electric or steam heating units available as optional equipment.

Send for illustrated 4-page folder. Write Dept. M-1259



NEW HOLLAND MACHINE COMPANY

NEW HOLLAND, PA.

and Myron Browning, Convair, Fort Worth. Standing, left to right, are Marshall Morris, H. I. Thompson Fiberglass Co., Fort Worth; Al Hohman, Chance Vought, Grand Prairie; Doug Layne, Dow Corning Corp.; Dick Pfaff, Anadite, Hurst, Texas; Bill Aves, Chance Vought, Grand Prairie; Dick Sharpe, Temco, Garland; Fred Howard, Bell Helicopter, Hurst; and D. C. "Nic" Novelli, Convair, Fort Worth. Novelli is chairman for the planning group.

Waterbury Branch

The branch had its regular meeting at the Roger Smith Hotel on Thursday, Oct. 8. The nominating committee presented its slate of delegates and alternates to the national convention for action by the meeting. The complete slate was elected.

Delegates: P. Sloane, W. Geisker, F. Tirendi.

Alternates: W. Innes, E. Couch, F. Schneiders.

The entertainment committee under Lou Porretti and Nick Topazio are formulating plans for the annual social evening which is to be held in February.

The speaker of the evening was R. F. McTeague, technical director, Stanley Chem. Co., who spoke on "New Plastic Coatings for the Electroplating Industry." His talk outlined the methods for fabricating the many objects being made out of plastisols and related compounds.

F. A. Schneiders
Publicity

Buffalo Branch

The October meeting was held Friday, Oct. 2, at the Peacock Inn in Mayville, N. Y., with 38 members and

8 guests in attendance. John Donaldson introduced the guests of the evening.

Dick Davis, librarian, introduced S. L. Doughty of the Lea Mfg. Co., Inc., who spoke on "Bright Cyanide Copper Plating."

Ray Kilroy was appointed chairman of the Sick Committee, and Ed Prickryl was elected to membership.

The January meeting will be held Friday, January 8, 1960, at the regular meeting place. C. H. Sample of International Nickel Co. will talk on "Corrosion Behavior and Protection Value of Electrodeposited Coatings."

Christopher Marzano, chief chemist of the Amphenol-Borg Electronics Corp., will speak at the February meeting on "How to Plate Difficult Metals."

Robert E. Lienert
Secretary

Rochester Branch

The November 2nd meeting was opened by Past-President Frank Beuckman at the Rochester German Club. The secretary was instructed to cast one vote for the following members to serve as delegates for the year and to attend the national convention in Los Angeles: Frank Beuckman; John Cipolla; Anthony Cottrone.

The forthcoming Christmas party of the branch to be held on December 19 was discussed at great lengths and steps taken to insure a good turnout.

Following the completion of business matters, the meeting was turned over to Emil Potridge, who presented the speaker of the evening, T. E. Swain of the Technical Service Department of Allied Chemical Corp. Mr. Swain gave an illustrated talk on "The Production, Uses and Importance of Chromium and Chromium Chemicals."

Following Mr. Swain's very interesting talk, refreshments were served

through the courtesy of the Scobell Chemical Company.

Barrie M. Gardner
Secretary

Kansas City Branch

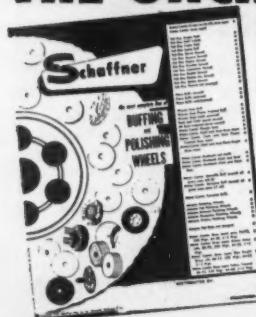
The first program in the field of organic finishing for the branch was the one held on Thursday, Oct. 15. Twenty-five members and guests assembled in the Topic Room of Regans' Restaurant at 7:00 P.M. and enjoyed a delicious fried chicken dinner. During the usual after-dinner break the speaker arranged on the head table an impressive array of multi-colored panels and test tubes.

When all was ready, Librarian Bill DesJardins introduced Ken Minert of the new products development section of an outstanding Kansas City industry, the Cook Paint and Varnish Co. Mr. Minert entitled his presentation "The Coatings Revolution." He first outlined the basic fundamentals in the manufacture of paints prior to 1950. He mentioned the various materials which were available for pigments and vehicles and the more or less conventional coating systems which were in use previous to that time. The bridge to the second part of his talk was concerned with the "Elements of a Protective Coating." The most interesting portion of his speech was his enumeration and discussion of materials and application methods which have been developed and come into use since 1950. Mr. Minert concluded with a look at the future of coatings and mentioned some of the things which are or are soon to be developed. A lively question and answer session followed, with some of those who are not directly concerned with organic finishes entering the discussion.

The officers and executive board,

THE UNCHALLENGED LEADER IN THEIR FIELD

Offers Exceptional Opportunity to
Industrial Salesmen of High Caliber
Representing **Schaffner**
BUFFING WHEELS and COMPOUNDS



FREE! SELF-SELLING 20-page catalog includes Schaffner's Buff 'n Polish Calculator, Speed Chart, illustrations.

FIRST CHOICE OF PARTICULAR BUFFERS everywhere—SCHAFFNER'S finest and most complete assortment of Buffing Wheels that provides a uniform finish on superior compounds made of laboriously controlled materials. New customers of SCHAFFNER are convinced it's the best more they ever made to increased, trouble-free production . . . for the quality, dependability and efficient service that SCHAFFNER is noted for.

SCHAFFNER MFG. CO.

NEW SCHAFFNER BIAS BUFFS PROVE A BIG SUCCESS, a terrific seller! Exclusive, new features give more mileage, longer life! YOU MARKET IS NO MOULDING, wood-working and metalworking shops, factories, rebuilders, jewelry manufacturers—SCHAFFNER is the answer to all buffing and polishing problems . . . your entree to record sales, and with excellent commissions, heavy repeat orders. Write TODAY for complete details, FREE CATALOG, and preferred territory.

Dept. M-5, 21 Herren Ave., Pittsburgh, Pa.



meeting before dinner, directed an audit of the books at the request of the treasurer. Delegates and alternates were named as follows: Delegates: *R. C. Garland, W. A. McGee, and A. C. West.* Alternates: *J. R. Thompson, Warren Eliot, and Glen Wilson.* Any members of the branch who would be in attendance at the Ft. Worth meeting in December were empowered to act for the branch in the matter of forming a regional group. The above items were approved by the entire membership present at the meeting.

*Robert L. Garrett
Secretary*

St. Louis Branch

The first fall meeting was held Oct. 14 at the York Hotel. There were 27 members and guests for dinner and 37 present when President *William Piel* called the business meeting to order.

After the minutes of the May meeting were read and approved and the treasurer's report was accepted, three new members were voted into the branch by unanimous vote. Communi-

cations during the long period of no business meetings were many, so only the important correspondence was acted upon at the meeting. The Mid West Regional conference at Rockford was discussed and it was pointed out that *Andy Julius* was serving on the finance & registration committee and *Craig McAlister* was on the inorganic panel of the workshop session.

A report of the number of people planning to attend the Los Angeles convention was shelved, to be answered at a later date. The following members were selected as delegates to represent the branch at the Los Angeles convention: *A. P. Julius, Louis J. Berra and William Piel.* Alternates were: *Craig McAlister, William George and Henry Siegel.* *Ed Sertl* reported that the plating school is again in full attendance with 28 in this fall class. *Otto Klein*, the instructor, had to go into the hospital for an operation and *Andy Julius* took over the class for two weeks.

The entertainment committee for the coming year was appointed as follows: *Eugene Conroy*, chairman; *Frank Menniges*, and *Louis Berra*. A

short discussion about the 1964 convention followed. It was pointed out that the riverfront memorial and the new sports stadium would probably be finished by then. This concluded the business meeting and *Richard Gotsch* introduced the speaker of the evening, *Karl Wagner*, technical service representative of Metal & Thermit who talked on duplex chromium. His talk was accompanied by slides showing the superior corrosion resistance, and he also covered the corrosion tests used in the preparation of the slide material. A very active question and answer period followed, and the meeting was adjourned at 10 P.M.

*Ward Kelly
Secretary*

Chicago Branch

The October meeting was held at Stella's Restaurant on Friday, Oct. 9th. Six memberships were approved by the board of managers and two new memberships were received. All members were urged to attend the first annual conference of the Midwest Regional Council of the A.E.S. at Rock-



For PLATERS, SILVERSMITHS, JEWELRY MFGRS., makers of Watches, Clocks and Electronics and other metal finishers. Supplied in straight or crimped brass, steel, nickel silver or stainless steel wire in sizes .0025 - .006 and in bristle, fibre or Nylon. Special sizes and shapes to order.

Write (Dep't. M) on your letterhead for catalog and price list.

DIXON & RIPPEL, INC. Box 116 Saugerties, N. Y.

TO BE AVAILABLE SOON!
NEW CONTROL KITS for
COPPER • CHROMIC ACID • CYANIDE
PLATING WASTE EFFLUENTS
~ WRITE FOR LITERATURE ~

KOCOUR CO.

Pioneers in Control for the Plating Industry

4802 S. ST. LOUIS AVE.

Chicago 32, ILL.



PLATING RECTIFIERS

SELENIUM • GERMANIUM • SILICON

UP TO 500 KW
WITH AND WITHOUT FULL AUTOMATIC CONTROLS.
COMPLETE STANDARD AND CUSTOM LINE.
ADVANCED DESIGN, LONG LIFE,
EFFICIENT AND ECONOMICAL UNITS
SEND FOR BULLETIN

Some territories open for jobbers and commission salesmen.

D J E C O
DIVISION OF
DJORDJEVIC ENGINEERING CO.
1933 N. DAMEN ARmitage 6-7308 CHICAGO 47, ILL.

METALLIZING NON-CONDUCTORS

\$2.00 PER COPY

* * * *

DICTIONARY OF METAL FINISHING CHEMICALS

\$3.00 PER COPY

* * * *

BOOK ORDERS PAYABLE IN ADVANCE

METAL FINISHING

381 BROADWAY

WESTWOOD, N. J.

ford, Ill. on Saturday, November 7, 1959. Two visitors from Spain attended the meeting.

Simon Gary, librarian, introduced the speaker of the evening, *Walter L. Pinner* of McGean Chem. Co., whose subject was a report on "Project #15." Mr. Pinner commented that the salt spray results were indefinite and weather exposure tests were much too long. The project then undertook the job of developing some useful tools for measuring plating quality of the copper-nickel-chrome and nickel-chrome plating systems. For this purpose, numerous panels were plated and exposed during the winter in the Detroit area.

Project #15, under guidance of Mr. Pinner also, developed the Cass Test which gave the same result on panels, as to type and extent of corrosion as the Corrodkote Test. Mr. Pinner concluded that the two tests arrive at the same end point and can prove to be useful tools to measure plating quality for the plating industry. After a lively question and answer period, Mr. Pinner was given a rising vote of thanks for his interesting and informative talk.

Christopher Marzano,
Publicity Chairman

Indianapolis Branch

Ladies' Nite was observed at the meeting on Oct. 6, at the Central Park Cafeteria, Arvin Industries, Columbus, Ind. Seventy delicious steak dinners with all the trimmings was served. President *Lee Reynolds* presided and asked for the secretary's and treasurer's reports. These were read and accepted. He gave a brief report of his trip to Detroit to attend the meeting of the National Membership Committee meeting of which he is the chairman. A new sustaining member is Western Electric Co. The November

meeting will be at the Delco-Remy Plant in Anderson of which the branch will be dinner guests.

The program for the evening was put on by the Better Business Bureau of Indianapolis. A film was shown by *Hugh Meyers* showing how easy it is for the public to be deceived by many people selling most anything nowadays. The meeting adjourned at 9:20 p.m.

Edna Rohrbaugh,
Secretary

Columbus Branch

The regular monthly meeting was held on Friday, Oct. 9, at 6:30 p.m. at Ricardo's Restaurant. Following the dinner, a short business meeting was held at which *Casper Meyer* was elected as a member of the Branch.

The 28 members and guests present heard an interesting account of "The Anodes' Side of the Story," from guest speaker *J. B. Winters* of Incar, Inc., Cleveland, Ohio. His talk was followed by an enthusiastic question period.

Leslie D. McGraw,
Secretary

Rochester Branch

The October 5th meeting was opened by 2nd Vice President *John Cippola* at the Rochester German Club. After dispensing with the routine business affairs of the Society, the meeting was turned over to *Frank O. Beuckman*, who acted as moderator for a round table discussion of plating problems. Following an active discussion by all present, refreshments were served through the courtesy of Don Blum Associates.

Barrie M. Gardner

Los Angeles Branch

By unanimous ballot of the 87 members present at its October 14 meeting, Los Angeles Branch voted against

having branch exhibits at the 1960 Supreme Society convention in Los Angeles. President *George Hetz* called for the vote after explaining that the officers and board of management had concluded that the expense involved in sponsoring branch exhibits and the limited budget available to the branch made it advisable to forego such displays. Hetz added, however, that if enough branches to create a healthy inter-branch competition favored such exhibits, Los Angeles Branch would go along with the majority despite the negative action at the October meeting.

Don E. Baudrand, *Glen Beckwith* and *Earl Coffin* were chosen as 1960 convention delegates, with *Don Bedwell*, *Stuart Krentel* and *Larry Henderson* as alternates.

Reporting further on the progress of 1960 convention arrangements, Hetz announced that local branch officers and committee chairmen had met in Los Angeles recently with National President *Ralph D. Wysong* of South Bend, Ind., and Executive Secretary *John P. Nichols* of Newark, N. J., and that both national officers had expressed gratification over the vigor with which Convention Chairman *Tony Stabile* and his committee heads were attacking the manifold problems allied with producing a national convention. Hetz announced also that the National Educational Committee had approved 37 technical papers for presentation at the Los Angeles convention which, according to Hetz, is the first time that more than 25 papers have been approved for a national convention.

Oscar Grisat, chairman of the research committee, reported the signing up of two new sustaining memberships—Royal Plating Co. and Ajax Hardware Co.

"DEFINITELY HELPED"

"The course has definitely helped," writes *Lew Briggs*, well known job shop owner of Erie, Pa., who up to the present has enrolled seven men, including himself, in ELECTRO-PLATING KNOW HOW. If plating is your business, you too will be definitely helped when you enroll in this unique home study course. Write Dr. Joseph B. Kushner, Electro-plating School, Box 2066, Evansville 14M. TODAY!

HAMILTON MILLS

INDIAN BRAND
TURKISH EMERY
For color and lustre beyond compare, specify INDIAN BRAND TURKISH EMERY. Preferred by those who know the best.
Also available—HECCO BRAND AMERICAN EMERY, for use in abrasive pastes and compositions.
HAMILTON EMERY & CORUNDUM CO.
CHESTER, MASS.

SOMMERS BROS. MFG. CO. MFRS. OF "BEACON"

Plating and Polishing Supplies and Equipment
—Complete Semi and Full Automatic Installations—Gold, Silver and Chrome Rouge, Stainless Steel and Satin Finish Compounds—Buffs, Polishing and Felt Wheels.

3439 NO. BROADWAY
ST. LOUIS 7, MO.

The chair reported that *Don Bedwell*, the branch's only honorary life member of the Supreme Society, had suffered a heart attack on a trip to Europe in mid-summer and was confined to his home in Inglewood in a serious condition.

Secretary *Harvey K. Hunt* reported receipt of information from the national secretary's office advising of the chartering of new A.E.S. branches in Phoenix, Ariz., and Denver, Colo. Phoenix Branch, according to Hunt, has expressed interest in forming a regional group including Phoenix, Los Angeles and San Francisco Branches and possibly, also Portland, Ore., and Vancouver, B.C. branches. Los Angeles Branch, Hunt advised, will be asked to voice its opinion on such a move when the plans mature more fully.

Visitors introduced at the October meeting by Sergeant-at-arms *Clare Ver West* included: *Louis M. Hague*, president of Hanson-Van Winkle-Munning Co.; *Myron B. Diggin*, vice-president and technical director; and *John E. Donnelly*, the firm's erection supervisor. Other guests were *Robert Speare*, Alert Supply Co.; *R. B. Jones*, L. H. Butcher Co.; *Henry Monsted*, Metal & Thermit Corp.; *G. E. Lebet*, Bowman Chem. Co.; *W. A. Zubel*, Independent Rack Co.; *Joseph LeBow*, Peterson Mfg. Co.; and *E. J. Richards*,

a member of Providence, R. I., A.E.S. Branch.

Librarian *Marjorie Farmer* presented the speaker of the evening—*Myron B. Diggin*, vice-president and technical director, Hanson-Van Winkle-Munning Co., Matawan, N. J. Mr. Diggin's talk dealt with "Durable Nickel-Chromium Deposits," which he illustrated with lantern slides.

throughout the country.

Surviving are his widow, *Freida*, and his two sons, *Milton* and *Harvey*, who are officers in the corporation.

MORRIS BAKER



OBITUARIES

DAVID LEVINE

David Levine, 69, founder and president of *Pesco Plating Equipment Corp.* and *Metal Finishing Manufacturing Co.*, Brooklyn, N. Y., died on October 18th, 1959, after a prolonged illness.

A resident of New York City, Dave has been associated with the metal finishing, plating equipment and supply industry for 50 years. Starting as a polisher with Landers, Frary and Clark, he went after several years into the polishing and finishing business with a partner, *Henry Nelkin*. Later Mr. Levine started his own corporation and in 1928, seeing a need for central supplies in the plating field, founded his own equipment and supply company. He was instrumental in the establishment of many plating plants

Morris Baker, founder and president of *M. E. Baker Co.*, died on October 31, 1959 at the age of 75, after a short illness.

Mr. Baker was a member of the American Electroplaters' Society since its inception, and an active member in good standing of the Boston Branch of the AES.

He leaves nine children, twenty-two grandchildren, and four great-grandchildren.

"pH PAPERS"

Accurate pH Values
in a few seconds
right at the tank.

Indicator AND control-colors on SAME strip. Control-colors in steps of 0.2 pH and 0.3 pH.

Plating ranges
(200 strips of a range per box)

Acid:	Alkaline:
6.0-7.4 pH	6.6- 8.0 pH
*4.8-5.2 pH	7.3- 8.7 pH
*3.6-5.0 pH	8.6-10.0 pH
*2.4-3.9 pH	10.1-11.3 pH
1.0-2.8 pH	10.5-13.0 pH
0.4-1.4 pH	11.0-13.1 pH

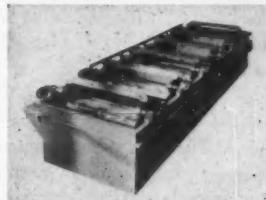
*Electrometric Values in Nickel Solutions.

Each range is boxed separately.

PAUL FRANK

118 East 28th Street NEW YORK 16
Tel. MU 9-5286

LAZO — The Pioneer for Better Metal Finishing



LAZO Model 2-SHSD . . . 6 Barrel Heavy Production Unit . . . Motorized

Size: 14"x36" inside cylinder dimen.
Size: Overall: 206"x63"x39" high
Tank: 202"x51"x30" high
1/2" Standard Perforations
Any Type Parts up to 4" dia.
All Plating Solutions
Holds up to 175 lbs. per barrel

Especially adaptable for cycle plating through electrocleaning and acid-pickling. Solid copper saddles for positive current-carrying capacities. Equipped with 6 side-drive Model 2-SHSD Lucite Barrels. Each barrel driven by its own heavy duty gearhead motor, mounted on outside of tank. Required anode and cathode bus bar connections. Quick loading and unloading through each barrel door. Equipped with motor starters.

Originators of Ribless Plating Barrels

HARDWOOD LINE MFG. CO.
2022 N. California Ave., Chicago 47, Ill.

for OVERNIGHT
DELIVERY
Call

American Buff Company

2414 S. LA SALLE ST.
CHICAGO 16, ILL.

CHICAGO • CALumet 5-1807

LOS ANGELES • LUdlow 3-4588

DETROIT • TRinity 5-9881

NEW YORK CITY • ORegon 9-2770

ATLANTA • TRinity 6-3168

News from California

By Fred A. Herr



Three main office executives of Hanson-Van Winkle-Munning Co. of Matawan, N. J., were visitors in Southern California in October: *Louis M. Hague*, president, was in Los Angeles from October 14 to October 26 for conferences with the heads of Alert Supply Co., Los Angeles, an H-VW-M subsidiary, and conferences and consultations with various plating industry personalities.

Myron B. Diggin, vice president and technical director, headquartered in Matawan, visited Southern California for a two-fold purpose: He attended a conference of the American Ordnance Association in Santa Monica, Calif., October 19, 20 and 21 to address that group on "Nickel for Military Applications;" and to deliver a talk before Los Angeles Branch of the A.E.S. on October 14 on "Durable Nickel-Chromium Deposits."

The third visitor from Matawan was *John E. Donnelly*, erection supervisor for the company. Messrs. Hague and Donnelly attended the A.E.S. meeting addressed by Mr. Diggin.

Earl Coffin, sales engineer for the Los Angeles branch of Chas. L'Hommeieu & Sons Co., and Mrs. Coffin, took to the air in mid-September for a 10 weeks flying tour of the world, a trip Earl had dreamt about, but had to forego because of business pressure during the 25 years or so when he operated a job plating shop in Los Angeles called Palace Plating Works.

According to information given to this column by *Carroll C. "Mac" McLaren*, Earl's associates on the L'Hommeieu sales staff, the Coffins' tour included visits to Honolulu, Tokyo, Hongkong, Thailand, parts of India, Tibet, Rome, Paris, and London. The return to Los Angeles was scheduled for about November 20.

Henry Sakland and *Justin R. Killgore* recently established a new plating shop in the Los Angeles area to which they have given the name of Vineland

Plating Co., a name derived from its street location at 5218 Vineland Ave., North Hollywood, Calif. North Hollywood is situated in the San Fernando Valley, just over the mountains from Hollywood, an area of considerable electronics and missile production and printed circuit requirements, a field in which Sakland and Killgore plan to specialize.

Sakland reports that the new shop has been equipped for concentration on printed circuit plating work. Among the 35 or so pieces of processing equipment are included facilities for gold, nickel, rhodium, tin-zinc, copper, through-hole plating, and immersion tin work. Sakland brings 20 years of diversified plating experience to the new venture and Killgore eight years.

Don E. Bedwell, who retired several years ago as plant supervisor for the Hall-Mak Company of Los Angeles, suffered a heart attack while he and Mrs. Bedwell were on a tour of Europe in August. A report given in mid-October revealed that Mr. Bedwell was confined to his home in Inglewood, Calif., under physician's orders to take it easy and avoid undue exertion. This situation made it necessary for Los Angeles Branch of the A.E.S. to alter plans for naming Bedwell a delegate to the 1960 A.E.S. convention in Los Angeles. The members of the branch felt that Bedwell, an honorary life member of the A.E.S., would make an ideal delegate at the convention but, under the circumstances, have selected a replacement.

Sel-Rex Corp., with executive offices located in Nutley, N. J., has established a new West Coast Office at 2180 Colorado Ave., Santa Monica, Calif., a suburb of Los Angeles, it has been announced. The new offices reportedly provide expanded facilities for additional personnel and warehousing of precious metals processes and equipment, offering efficient handling and prompt deliveries to customers in the area.

Walter H. Walczyk, formerly chief chemical engineer, Remington-Rand Univac (engineering development section) who was recently appointed West Coast representative, has been assigned the additional responsibility of heading-up all sales and service activities in the area, according to the announcement.

It is reported that Mr. Walczyk's



Walter H. Walczyk

heavy background in the development and manufacture of printed circuits has necessitated almost constant traveling along the West Coast, since his arrival, because of the heavy concentration of electronic industries and their great interest in sophisticated printed circuitry.

The firm had sent a letter to customers and prospects in the area, announcing Walczyk's availability for consultation on any production problem falling within the scope of his experience, and/or the company's operations.

Construction of building and installation of equipment was expected to be completed before the close of 1959 on a new \$3,500,000 plant at Torrance, Calif., for the R. C. Mahon Company of Detroit, Mich., manufacturers of metal finishing systems and equipment.

The new West Coast facility is located on a 30 acre site 13 miles southwest of downtown Los Angeles and just north of the San Pedro section of Los Angeles Harbor.

The new plant will include a 200,000 sq. ft. manufacturing building and a 10,000 ft. structure devoted to administration and engineering activities. *Walter G. Mitchell* is executive vice president of the company's Western Division.

Jack Montgomery, vice president of Modern Plating Co., Los Angeles, has been elected president of the Metal Finishing Association of Southern California, succeeding *Walter P. Behlendorf* of Spence Electroplating Co., Los Angeles.

Bert Sherwood, president, Chemplate Corp., was named vice president of the association, and *E. Paul Koeckritz, Jr.*, was re-elected treasurer. The new officers were installed at the MFASC regular monthly meeting at Rodger Young Auditorium, Los Angeles, on the night of October 21.

Harold E. Coombes, Sr., president of Crown City Plating Co., Pasadena, and *Harold E. Coombes, Jr.*, chairman and co-chairman of the convention committee, announced that plans for the convention of the National Association of Metal Finishers were drawn at a recent meeting of Los Angeles Chapter. The convention is scheduled to be held in Los Angeles in mid-July, 1960.

The following chairmen for convention committees have been appointed: Hotel and banquet, *L. J. Lundt*, Atlas Plating Co.; Management Seminars, *Jack Montgomery*, Modern Plating Co.; Entertainment, *Bert Sherwood*, Chemplate Corp.; Plant Visitation, *Bruce Smith*, Metal Treaters; Finance, *Walter Behlendorf*, Spence Electroplating Co.; Registration, *Francis Odell*, Metal Surfaces, Inc.; Public Relations,



J. T. Cataldo

dent for marketing, and for many years known in the industry for his extensive contributions to the electronic/electrical semiconductor field, will now administer all phases of engineering for the company, and will direct an accelerated new product design and development program.

In addition to holding degrees in mechanical engineering from Clarkson College of Technology and in electrical engineering from Brooklyn Polytechnic Institute, Mr. Cataldo has done postgraduate work with Rutgers University Extension School and with UCLA.

Mr. Conto, formerly industrial sales manager, has been responsible for the sales programs of several prominent firms in the electronics field. In his new position he will direct the sales activities of the Industrial, Distributor and Military Sales Divisions of the company.



Jack Montgomery

E. Paul Koeckritz, Los Angeles Parkerizing Co.; and Ladies Entertainment, *Mrs. Bert Sherwood* and *Mrs. L. J. Lundt*.

The promotion of *J. T. Cataldo* to the office of senior vice president, and of *James Conto* to the position of general sales manager, has been announced by *International Rectifier Corp.*, El Segundo, Calif.

Mr. Cataldo, formerly vice presi-

Pacific Coast region and new developments and techniques in that field.

Aluminum Company of America has announced that three Southern California metal finishing companies have been named licensees of its new Duranodic finishes. The licensees are *King Anodizing Co.*, Burbank; *Anadite, Inc.*, South Gate; and *Baker Metal Finishing Co.*, Monterey Park.

The annual production of the plastics industry in the United States, which in 1959 will total five billion pounds of raw material, may run as high as an annual output of 150 billion pounds in the next 50 years, according to estimates given at a 2-day technical conference of the Society of Plastics Engineers held October 13 and 14 at the Ambassador Hotel, Los Angeles.

William T. Cruse, national vice president of the society, who was a member of a committee that recently investigated the Russian plastics industry, reported that the Soviet is producing about 500 million pounds of plastics annually, one-tenth the present American output. Cruse said that virtually all of the Russian production of plastics is devoted to military and industrial uses, and that celluloid dolls and plastic dishes are about the only consumer items available.

Russell Weigel, national president of the society, and *Samuel Oleksy*, a Gardena, Calif., plastics research engineer, emphasized the importance of creating new materials to meet specified needs, such as heat, stress and strain and corrosion demands.

Raymond B. Seymour of Los Angeles, conference co-chairman, disclosed that the Southern California plastics industry produces 12% of all plastic goods produced in the United States. Seventy five per cent of reinforced plastics used in missiles and aircraft, according to Seymour, is produced in Southern California in which are operated 220 plastics firms employing 5,500 persons.

Others who addressed the conference included *Fred C. Sutro, Jr.*, president of the Society of Plastics Engineers; *Albert E. Forster*, president and board chairman, Hercules Powder Co.; *Russell Weigel*, national president, Society of the Plastics Industry; and *W. E. Zisch*, vice president and general manager of Aerojet-General Corp.

ADVERTISING RATES	
Per column inch per insertion	
1 time	\$12.00
3 times	11.00
6 times	10.00
Yearly (12 times)	9.00

READY REFERENCE SECTION

CLEANING • POLISHING AND BUFFING • ELECTROFORMING
 ANODIZING • RUSTPROOFING • PLATING • BARREL FINISHING
 VACUUM METALIZING • LACQUERING AND ENAMELING

IT'S A FACT! 112,000 AMPERES OF PLATING POWER AS IS OR REBUILT AND GUARANTEED **BARGAIN - PRICES** NO REASONABLE DEAL REFUSED

GENERATORS

- 1—6000/3000 Amp. 6/12 volts, Chandeysen. (synchronous)
- 1—5000/2500 Amp. 6/12 volts, H.V.W. (synchronous)
- 1—6000/3000/1500 Amp. 6/12/24 Volts H.V.W.
- 1—6000 Amp. G.E. Automatic Voltage Controller
- 1—5000/2500 Amp. 6/12 volts, Bogue
- 1—1660/880 Amp. 6/12 volts, G.E.
- 1—1500 Amp. 40 volt Hobart 100 HP, AC Drive
- 3—1000/500 Amp. 7½/15 volts w/controls, Hobart, M. G. Corp.
- 2—1000/500 Amp. 6/12 volts, Bogue
- 1—750 Amp. 6 volts, Star Kimball
- 2—750/375 Amp. 6/12 volts H.V.W.
- 3—500/250 Amp. 6/12 volts, w/control, H.V.W., Chandeysen, Hobart
- 1—500/250 Amp. 7½/15 volts, single phase, Hobart
- 1—400 Amp. 30 volts, Electrical Products
- 6—300 Amp. 6 volts, H.V.W., Hobart, Roth w/control
- 2—200 Amp. 6-7½ volts, Hobart, Roth
- 15—100 Amp. 7½ volts, Hobart, M.G. (NEW & USED)
- 10—100 Amp. 24 volts, Generators only
- 11—125 Amp. 6 volts, Generators, Hobart (NEW)

RECTIFIERS

- 1—4000 Amp. 6 volts, Udylite, selenium
- 1—2000 Amp. 6 volts, Udylite, selenium w/control
- 12—2000/1000 Amp. 6/12 volts, G.E.
- 8—1500/750 Amp. 6/12 volts, Udylite, w/control
- 1—1000 Amp. 6 volts, Green, w/control, 2 or 3 phase
- 1—1000 Amp. 6 volts, Lewis, w/control
- 1—1000 Amp. 12 volt Placo Sel. with Control
- 2—750 Amp. 6 volts, Rapid, w/control
- 1—500 Amp. 48 volts, Sel-Rex Automatic Programming Control
- 4—500 Amp. 6 volts, Rapid, Green, Lewis, Udylite, w/control
- 10—500 Amp. 6 volts new G.E. Copper Oxide
- 12—500 Amp. 6 volts, G.E. w/new selenium stocks and control
- 6—300 Amp. 6 volts, G.E. w/new selenium stocks and control
- 2—250 Amp. 12 volts G.E. w/control
- 12—200/100 Amp. 14/28 volts, Theo, w/control
- 2—100 Amp. 6 volts w/control
- 2—50 Amp. 6-15 volts w/control
- 2—25 Amp. 6-10 volts w/controls
- 10—New G.E. controls
- 10—G.E. controls 1-4 units of 500 Amp.
- 1—6000 Amp. 6 to 9 volts w/remote automatic control
- 1—3000 Amp. 12 to 18 volts w/remote automatic control
- 1—2000 Amp. 24 volts w/remote automatic control

PLATING AND POLISHING ACCESSORIES

Plating, Polishing, Grinding, Sanding, Spraying, Drying, Tumbling, Cleaning, Baking, Degreasing and Anodizing Equipment
 Anodes, Chemicals, Acids, Cyanides
 Solvent, Supplies for Wood, Plastics and Metals

Pesco Plating Equipment Corp.
 75 Wythe Ave. Brooklyn 11, N. Y.
 EVERgreen 4-7472 • 3-4

USED.. NOT ABUSED EQUIPMENT ALL OF THE EQUIPMENT LISTED BELOW IS FULLY RECONDITIONED AND GUARANTEED IN STOCK

POWER EQUIPMENT

- 1—H-VW-M Mtr. Gen. 750/A—8 V.
- 1—American Giant 750 amps. 6 volts
- 3—Udylite rectifiers 1500/750 amp. 6/12 V.
- 2—R-A 500 amp., 6 V. with control.
- 3—G. E. 500 amps. 6 volts with control.
- 1—Rapid 300 amps. 6 volts with control.
- 1—Udylite 500 amps. 6 volts with control.
- 5—from 12' to 32' long for nickel and cyanide.

PLATING BARRELS

- 2—Daniels #3.
- 3—Lasalco steel 36 x 18 Lucite cylinder.
- 1—Lasalco rubber lined 30 x 15.
- 1—H-VW-M steel 36 x 18.
- 1—Udylite steel—42 x 15.
- 2—Udylite multi-purpose barrel — hard rubber cylinder.

FILTERS

- 10—Industrial, Alsop, Saitco — all sizes — nickel and cyanide solutions.

TUMBLING BARRELS

- 2—Abbott barrels, variable speeds.
- 1—#2 Baird production Tumbler.
- 10—Baird barrels 2C tilting type.
- 8—Henderson barrels 5A tilting type.
- 4—Globe barrels.

POLISHING MACHINES

- 1—Production Machine #101 — 7½ H.P.
- 4—#101 Tandem 15 H.P.
- 2—Production Machine #484-2.
- 5—Acme A2.
- 3—Acme B10.
- 2—Divine Model VM-10 — 10 H.P.
- 2—L'Hommedieu 5 H.P. variable speed.
- 15—Holland 5 H.P. — 7½ H.P. — 10 H.P.
- 1—Acme L-82 — 7½ H.P.
- 4—Gardener 5 H.P. — 7½ H.P.
- 6—Divine Idlers.

DRYERS

- 1—Ronci R100.
- 2—Barrett centrifugal dryers.
- 2—Kraider #12 steam explosionproof mtrs.

BOILERS

Kane gas fired 20 H.P., 7½ H.P.

RHEOSTATS — all sizes

MISCELLANEOUS

- 1—Detrox alkaline belt washer.
- 1—Philips electric degreaser.
- 1—Blakelite pump type washer.
- Blowers and motors—multivane (fume) pedigree wheel (dust).
- 1—Blakelite washer.

TANKS

- 300—All sizes — all linings.

COMPLETE PLANTS PURCHASED —
SURPLUS EQUIPMENT WANTED.

LINDALE
 EQUIPMENT AND SUPPLY CORP.
 504 SMITH ST., BROOKLYN 31, N. Y.
 Phone: TRIangle 5-4353

Save More
IMMEDIATE SHIPMENT!

Select from one of the nation's largest stocks of guaranteed rebuilt electro-plating motor generator sets and rectifiers with full control equipment.

PLATERS

- 1—7500/3750 AMPERE 9/18 VOLT. H-VW-M, Synch.
- 1—7500/3750 AMPERE, 6/12 VOLT, 25°C. CHANDEYSSEN, Synch.
- 1—6000/3000 AMPERE, 6/12 VOLT. ELECTRIC PRODUCTS, Synch.
- 1—5000/2500 AMPERE, 12/24 VOLT. CHANDEYSSEN, Synch.
- 2—5000/2500 AMP., 9/18 V., 25°C., CHANDEYSSEN, Synch. Exciter-in-head.
- 1—5000/2500 AMPERE, 6/12 VOLT, 25°C. CHANDEYSSEN, Synch.
- 1—4000/2000 AMPERE, 6/12 VOLT. H-VW-M, Synch., Exc.-in-head.
- 3—3000/1500 AMPERE, 12/24 VOLT, CHANDEYSSEN, Exciter-in-head.
- 1—2000/1000 AMPERE, 6/12 VOLT. H-VW-M.

ANODIZERS

- 1—1000 AMPERE, 40 VOLT. CHANDEYSSEN, 25°C.
- 1—1000 AMPERE, 30 VOLT. IDEAL, Exciter-in-head.
- 1—500 AMPERE, 25 VOLT. CHANDEYSSEN, Synchronous, Exciter-in-head.
- 2—400 AMPERE, 40 VOLT. M.G.C., Separately Excited.

RECTIFIERS

- 1—G. E. 2000/1000 AMP., 6/12 V.
- 1—SEL-REX SELENIUM, 1200 AMPS, 9 V for 440/3/60.
- 1—1500/750 AMPERE, 6/12 VOLT, UDYLITE-MALLORY.
- 1—NEW G. E. 2000/1000 AMPS, 6/12 V. Remote Control 440/3/60 AC.

SPECIAL

- 2—CROWN & H-VW-M Centrifugal Driers No. 1 and No. 2 with Heat.
- 2—MERCIL Ball Burnishing Barrels, Sizes 1 and 2.
- 3—LASALCO Ball Burnishers, Sizes 1, 2 & 4. Lined or unlined.
- 1—L'HOMMEDIEU 5 H.P. Variable Speed Buffer, Model 18.
- 2—INDUSTRIAL RDR-1 Rubber-Lined Filters, Sizes 10x28, 14x36.
- 10—BUFFING LATHE — HAMMOND, DIVINE, U. S. etc. from 3 H.P. to 20 H.P.
- 2—INDUSTRIAL Type SC Filters for Cyanide, 18x48 and 18x36.
- 4—STEVEN-BADER Abrasive Belt Polishers.
- 3—AMERICAN Blower Type HS Fans, Size 330-10.
- 15—DUSKOP Dust Collector Cabinets, Sizes No. 550, No. 850, No. 1100.
- 1—H-VW-M Type (Mechanical lift) full automatic, Plating Machine, 70' long x 4' wide x 36" deep x 10½' overall height.

Other outstanding values in stock.
 1929-1959 — 30 Years of Service.

M. E. BAKER CO.

Kirkland 7-5460

25 Wheeler St., Cambridge 38, Mass.

ADVERTISING RATES	
Per column inch per insertion	
1 time	\$12.00
3 times	11.00
6 times	10.00
Yearly (12 times)	9.00

READY REFERENCE SECTION

CLEANING • POLISHING AND BUFFING • ELECTROFORMING
 ANODIZING • RUSTPROOFING • PLATING • BARREL FINISHING
 VACUUM METALIZING • LACQUERING AND ENAMELING

Rely on RELIABLE FOR New and Rebuilt GUARANTEED EQUIPMENT GUARANTEED POWER

Chandeysson Generators

- 1-10,000/5,000 Amp. 12/24 Volt.
- 2-12,000/6,000 Amp. 6/12 Volt.
- 1-7,500 Amp. 9 Volt.
- 1-5,000 Amp. 9 Volt.

H-V-W-M Generators

- 1-15,000 Amp. 9 Volt.
- 1-4,000 Amp. 6 Volt.

RECTIFIERS & CONTROLS

- 6-Wagner 1500/750 Amp. 9/18 V. New.
- 2-Wagner 1500/750 Amp. 6/12 V. New.
- Wagner 3 Unit Regulator 42 KVA New.
- Wagner Promat Kicker 20 KVA New.
- Wagner Promat Kicker 50 KVA New.
- Wagner Kicker Regulator 20 KVA New.
- 1-Steven Standard Regulator 200 KVA.
- 1-Udylite Standard Regulator 50 KVA New.

RELIABLE Industrial Equipment Co.

633 RICHMOND STREET
GRAND RAPIDS 4, MICH.

Phone Riverside 2-2607

Better Buys

Better Equipment

Generator Power Available from 30¢ per Amp. and up.

- 1- 9 Volt - 10,000 Amps.
- 1- 7 Volt - 10,000 Amps.
- 1- 6 Volt - 10,000 Amps.
- 1- 9 Volt - 7,500 Amps.
- 1- 6 Volt - 7,500 Amps.
- 1- 6 Volt - 6,000 Amps.
- 1-18 Volt - 5,000 Amps.
- 1- 7 Volt - 5,000 Amps.

RECTIFIERS

- 1-1000 Amp. 0- 6 Volt
- 1-1000 Amp. 0-12 Volt
- 1-1500 Amp. 3-12 Volt
- 1-1500 Amp. 0- 6 Volt
- 1-2000 Amp. 0- 6 Volt

FILTERS

- 2-18x48x40 Type SCW-2 - Industrial
- 1-54x36x30 Type SCWB2
- 1-36x60x48 RDR-2
- 1-15 ton refrigeration - Chrysler Air-Temp.
- 1-2 ton Frostrode chiller

PLATING MACHINES

- 3-Hanson-Van Winkle-Munning - two lane 64 inch lift. Adapted for copper-nickel and chrome
- 1-Semi-automatic nickel plater.
- 1-Semi-automatic - for copper, cadmium or zinc
- 1-Udylite return type - fully automatic horizontal zinc or cadmium plating machine - 16-36 cylinders - Bright and dichromate. Can be skipped or delayed

Rheostats - 200 Amp. and up
 Hanson-Van Winkle-Munning - Columbia

Mercil plating barrels -
 Ranshoff spiral dryers

All sizes - rubber, Koroseal lined
 and steel tanks.

PLATING SERVICE AND EQUIPMENT CORP.

3620 Hart St. Detroit 14, Mich.
 Phone: Valley 3-1852

Hard to find . . .
 in perfect condition
 used

AUTOMATIC Polishing and Buffing Machines



Acme
Model
E-10



Acme
Model
B-10



Acme
Model
A-2

7-7ROH Hammond Polishing and Buffing Lathes.

3-7RH Hammond Polishing and Buffing Lathes.

1-Acme Skillet Lathe Machine.

CLINTON SUPPLY COMPANY

112 So. Clinton St.

Chicago 6, Ill.

Franklin 2-3538

TELEPHONE COLLECT ~

ADVERTISING RATES
Per column inch per insertion
1 time - \$12.00
3 times - 11.00
6 times - 10.00
Yearly (12 times) 9.00

READY REFERENCE SECTION

CLEANING • POLISHING AND BUFFING
ANODIZING • RUSTPROOFING • PLATING • ELECTROFORMING
VACUUM METALIZING • LACQUERING AND ENAMELING
• BARREL FINISHING

PARTIAL LIST OF REBUILT EQUIPMENT WITH A NEW GUARANTEE

D.C. POWER

HVWM 10,000/5000 Amperes 6/12 volts.
HVWM 7,500/3750 Amperes 6/12 volts (2).
RAPID 6,000 Amperes 6 volts remote controlled.
ELECTRIC PRODUCTS 2500/1250 Amperes 6/12 volts.
CHANDEYSSON 2500/1250 Amperes 6/12 volts.
WAGNER 1500/750 Amperes 6/12 volts.
CHANDEYSSON 400 Amperes 30 volts

FILTERS

Industrial, 10x28 RDR-2.
Industrial, 14x28 SCW-2.

SEMI AUTOMATICS

20-ft. nickel HVW.
18-ft. copper HVW.
15-ft. chrome HVW.

PURIFICATION

Three Way Disposal System.

HEAT EXCHANGERS

Industrial, one, two and four tube systems with duriron pumps and motors.

RHEOSTATS & SWITCHES

3—Crown 200 Ampere units.

1—Crown 500 Ampere unit.

PLATING BARRELS

1—Udylite 30x14 lucite Koroseal Lined.

TUMBLERS

2—Supersheen submerged units, lined tanks, variable drives, platecoils and temperature regulators.

Industrial, 18x28 RDR-1.
Industrial, 14x3630 RDR-2.

AUTOMATICS

Udylite 40-ft. copper.
HVW 80-ft. copper, nickel
& chrome.

Industrial Deionization System.

BRUCAR EQUIPMENT & SUPPLY CO. INC.

604 - 20th STREET

Telephone: TRIangle 1-4100

BROOKLYN 18, N. Y.



IDEAL TACK RAGS

For a Perfect Finish
Bulk or Bagged

IDEAL CHEMICAL COMPANY
1499 Dean Drive
So. Euclid 21, Ohio
EV 1-4111 — EV 2-1111

PLATERS AND ANODIZERS

M-G SETS — Motor 3-60-220/440

Amp.	Volt	Make
125	40	Star
200	65	G. E.
300	7½	Hobart
333	30	G. E.
400	80/80	G. E.
500	60	Westinghouse
688	47.5	Elec. Prod.
750 (Twin)	6	H-V-W
750/375	6/12	Excell-All
845	47.3	Elec. Prod.
940	32	Elec. Prod.
1000/500	6/12	Chandeysson
1000/500	8/16	Chandeysson
1000/500	12/24	H-V-W
1500/750	6/12	G. E.
1500	30/50	Century
1500	40/65	G. E.
1500	65	Westinghouse
1500	70	Century
2000	6	Eager
2500 1250	6/12	Elec. Prod.
5000/2500	6/12	Columbia

SHUNTS

5,000 Amp. 50 mv.
6,000 Amp. 50 mv.
10,000 Amp. 50 mv.
15,000 Amp. 50 mv.

MOTOR REPAIR & MANUFACTURING CO.
1555 HAMILTON AVE., CLEVELAND, OHIO

USED BUFFS FOR SALE

Spiral sewed — sisal — Airway type.

IMMEDIATE DELIVERY

Samples sent

MICHIGAN BUFF CO., INC.

3503 Gaylord Avenue
Detroit 12, Michigan
Twinbrook 3-2200



WORTHY STRAINER

STRAINS PAINTS
AND VARNISHES
AS YOU SPRAY

Consult Your Paint
Dealer or Order
Direct From Factory
in Lots of 12

WORTHY PRODUCTS CO.
Box 123 Temple, Pa.
Send For Literature

EQUIPMENT FOR SALE

14 x 30 Udylite barrels.

14 x 24 Hanson lined barrels.

Three 24" Cage blowers.

One Mercil burnishing barrel.

Rectifiers, Mixers, Tanks, Dryers
and numerous other items.

Δ

E. H. KIRKPATRICK & SON, INC.
124 Smith Ave. Kingston, N. Y.
Telephone — Federal 1-0137



BAKER BROS., INC.

Route 138, Canton, Mass.

DAvis 6-6630

QUALITY REBUILT PLATING • POLISHING & TUMBLING EQUIPMENT

~ One of the Largest Stocks in the Country ~

ADVERTISING RATES	
Per column inch per insertion	
1 time	\$12.00
3 times	11.00
6 times	10.00
Yearly (12 times)	9.00

READY REFERENCE SECTION

CLEANING • POLISHING AND BUFFING • ELECTROFORMING
 ANODIZING • RUSTPROOFING • PLATING • BARREL FINISHING
 VACUUM METALIZING • LACQUERING AND ENAMELING

PLATING AND POLISHING EQUIPMENT FOR SALE

AUTOMATIC PLATING MACHINES

51' Udylite st. nickel or nickel and chrome or brass. Can be used for zinc, cadmium and copper. Tank 36" deep, 32" length of travel.

30' Udylite machine rebuilt for nickel and brass plus lacquer dip set up. Tank 36" deep, 32" length of travel.

12 Station Udylite rotary automatic zinc, cadmium, copper, etc. 7' x 36" x 48" tanks double rod.

70' H-VW-M double rack machine, tanks 3' length of travel, 5½" wide, 5' deep.

28' Udylite chrome plating machine, converted to sulphuric and anodizing, tank 32" length of travel, 72" deep. 20' x 42" x 48" deep semi automatic tank, Koroseal lined.

Complete Udylite barrel plating line 14 x 30 cylinders, cleaning, pickling, rinsing, 1-4 cylinder and 1-6 cylinder plating unit with electrified overhead rail. Centrifugal dryers. 5-Henderson tumbling barrels, 4' Grav-i-Flo tumbler. (Will sell all or part.)

AUTOMATIC POLISHING MACHINES

1—4 spindle semi-automatic

1—8 spindle semi-automatic

1—Hammond 6 spindle with 4—10 H.P. heads

2—2 spindle semi-automatics

3—Packermatic 9 spindle, 56" table with 7 heads

1—Divine 8 spindle 45" table with 3-5 H.P. heads.

1—Packermatic 12 spindle 60" table with 7 Packermatic stands

40—Acme and Murray-Way polishing and sanding heads, 5-15 H.P.

PESCO PLATING EQUIPMENT CORP.

75 WYTHE AVE.

EVergreen 4-7472-3-4

BROOKLYN 11, N. Y.



CLEANING
PLATING



Metal Finishing

A Monthly Publication

POLISHING AND BUFFING • ELECTROFORMING • ANODIZING • RUSTPROOFING
 BARREL FINISHING • VACUUM METALIZING • LACQUERING & ENAMELING

381 BROADWAY, WESTWOOD, N. J.
 NORTH 4-1530

Now ready for distribution . . .

1960 GUIDEBOOK - DIRECTORY

756 pages of "know-how"

Get your copy plus 12 issues of Metal Finishing
 for only \$5.00

SEND ORDER TO THE ABOVE ADDRESS

ADVERTISING RATES

Per column inch per insertion	
1 time	\$12.00
3 times	11.00
6 times	10.00
Yearly (12 times)	9.00

READY REFERENCE SECTION

CLEANING • POLISHING AND BUFFING • ELECTROFORMING
ANODIZING • RUSTPROOFING • PLATING • BARREL FINISHING
VACUUM METALIZING • LACQUERING AND ENAMELING

PLATING GENERATORS FOR SALE

- 3—10000/5000 Amp., 6/12 Volt Chandeysson MG Sets, Direct Connected Exciter, Panel and Starter (1948). Like New.
- 1—10000/5000 Amp., 9/18 Volt Chandeysson MG Set, Direct Connected Exciter, Panel and Starter (1952). Like New.
- 1—10000/5000 Amp., 6/12 Volt H-VW-M MG Set, Panel and Starter.
- 1—5000/2500 Amp., 9/18 Volt Chandeysson MG Set, Direct Connected Exciter, Panel and Starter, 25 Deg. (1948). Like New.
- 1—2000 Amp., 50 Volt, Chandeysson, 25 Deg. Anodizer, Direct Connected Exciter, Panel and Starter (1954). Like New.

We have several of the above machines located in Midwest. Priced Right, Available Immediately.

ALAN BAKER COMPANY

180 Sylvester Reed
South San Francisco, Calif. PLaza 5-6506

JOB SHOP WANTED

Interested in purchasing established reasonably small (one or two man) job shop, preferably in south or southwestern U. S. Please send full particulars. Address: December 1, care Metal Finishing, 381 Broadway, Westwood, N. J.

MACHINERY FOR SALE

- 1—Detrox degreaser, very clean, serial #14530
3 dip cross rod with 125 gallon still.
\$3,700.00.
 - 1—Acme automatic Rotary Table 8 ft. 8 spindle, like new. \$3,500.00.
- Address: December 2, care Metal Finishing, 381 Broadway, Westwood, N. J.

HOIST LINE EQUIPMENT FOR SALE

2—6,000 Amp., 12 Volt Chandeysson MG sets.
20—Tanks—90" long, 55" deep, for Hoist line.
31—Plating racks for above.
Excellent condition—located in midwest—\$12,000.00 total price, complete.
Address: December 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

PLATING SHOP — FLORIDA

Will sell, lease or consider partnership with fully experienced plater-polisher. Established shop well equipped to handle full range metal finishing on production basis. Excellent growth opportunity. Terms reasonable. Inquiries and offers invited. Address: December 4, care Metal Finishing, 381 Broadway, Westwood, N. J.

LIQUIDATION SALE

- 2—Production No. 101 Centerless Polishing Machines, Connected in tandem, 15 HP 220/440 Volt — \$1,800.00.
 - 1—Plating Generator—2000A 6/12 Volt output with exciter and 20 HP Synchronous Motor 220/440 V. — \$1,800.00.
 - 1—Udylite Semi-Automatic Nickel Plating Machine. Tank Size 48" x 56" x 17". (2) Karbate Heaters & Solution — \$3,800.00.
 - 1—1500A Generator with Control & Meters — \$1,200.00.
 - 2—200A Rectifier — Udylite — 1-8 years old — \$300.00. 1-5 years — \$325.00.
 - 1—Chrome Plating Tank — Koroseal Lined 4 ft. Deep, 4 ft. Wide, 6 ft. Long—\$200.00.
- Address: December 10, care Metal Finishing, 381 Broadway, Westwood, N. J.

SITUATIONS OPEN**INDUSTRIAL PLATERS**

SITUATIONS OPEN—Leading national manufacturer of electronic wiring devices has openings for experienced industrial platers at its Carlisle, Pa. factory. Candidates should have at least 3 years plating experience, preferably in precious metals, although any type of specification plating will be considered. Candidates should also have a chemistry and mathematics background in order to work with formulas, make calculations and mix and maintain solutions. Send inquiries to AMP, Inc., Personnel Dept., 2100 Paxton St., Harrisburg, Pa.

EQUIPMENT ENGINEER

SITUATION OPEN—Leading supplier of plating equipment desires experienced engineer to prepare specifications and quotations for customers. Salary open. Connecticut location. Our employees know of this ad. Address: December 6, care Metal Finishing, 381 Broadway, Westwood, N. J.

CHEMISTS OR CHEMICAL ENGINEERS

SITUATIONS OPEN—Illinois manufacturer with extensive metal finishing operations has several job openings for men under 40 in both technical and supervisory classifications. Fine opportunities with progressive company in an ideal family community. Send complete resume and picture. Address: November 8, care Metal Finishing, 381 Broadway, Westwood, N. J.

RESEARCH CHEMIST

SITUATION OPEN—Chemist or chemical engineer with demonstrated ability to originate new plating processes. Work for technical director of specialized plating job shop in Los Angeles. Write giving technical education, experience, and salary required. Address: November 2, care Metal Finishing, 381 Broadway, Westwood, N. J.

ENGINEER

SITUATION OPEN—Mechanical design engineer wanted by S. W. Michigan machinery manufacturer. Preferably with experience in automatic polishing and buffing machinery. State age, experience and salary desired. Address: December 12, care Metal Finishing, 381 Broadway, Westwood, N. J.

**METAL FINISHING SUPERINTENDENT
NEW ENGLAND STATE**

SITUATION OPEN—Must have complete knowledge of all phases of finishing, cleaning, plating, enameling, buffing; must be capable of assuming both technical and administrative responsibility of finishing plant; direct program of development of new finishes and new finishing techniques. Address: December 5, care Metal Finishing, 381 Broadway, Westwood, N. J.

**AUTOMATIC BUFFING FOREMAN
METROPOLITAN VICINITY**

SITUATION OPEN—Setting up and operating automatic buffing equipment, rotary, and semi-automatics. State salary, past experience, references. Confidential. Address: December 7, care Metal Finishing, 381 Broadway, Westwood, N. J.

**BUFFING COMPOUND
CHEMIST**

SITUATION OPEN—Manufacturer of greaseless and full line of buffing compositions needs chemist with four years or more experience in glue, fats and abrasives. Exceptional opportunity. Reply, submitting full resume of experience and references. Address: December 11, care Metal Finishing, 381 Broadway, Westwood, N. J.

SALES ENGINEER

SITUATION OPEN—Electroplating background to handle process and equipment sales and service for midwestern territory. Emphasis on precious metals and military specification work. Willing to relocate. State experience and salary requirements. Address: December 13, care Metal Finishing, 381 Broadway, Westwood, N. J.

SITUATIONS WANTED**SUPERVISOR**

SITUATION WANTED—Man with twenty-five years experience in all types of plating and finishing desires position in supervisory or process engineering. Address: December 8, care Metal Finishing, 381 Broadway, Westwood, N. J.

**POLISHING & BUFFING
SUPERVISOR**

SITUATION WANTED—Twenty-seven years experience. Have knowledge of zinc die casting, stainless steel and steel; also electroplating, set-up and process buffing and polishing. Age 48, married, two sons. Would like to relocate in California. Address: November 9, care Metal Finishing, 381 Broadway, Westwood, N. J.

PLATING FOREMAN

SITUATION WANTED—Age 25, seven years experience all phases plating field — managing, processing, laboratory controls, trouble shooting. Diversified experience includes barrel plating, polishing, waste disposal, plating, chrome plating, plating, powder, vacuum metalizing—in both large and small plants. Seeking permanent position. Willing to relocate. Address: December 9, care Metal Finishing, 381 Broadway, Westwood, N. J.

ELECTROPLATING ENGINEER

SITUATION WANTED—Possess highly diversified background in electroplating and metallurgy. Capable of R&D, processing and production. Electroplating experience in base metals and some alloys, the precious and platinum group metals for decorative, environmental and engineering use. Metallurgy consists of foundry, metals joining, fabrication and heat treating as well as surface treatments such as hardening, soft solders, aluminum/silver brazing, and welding; jewelry and electronic tubes. Well versed in complex chemical analysis and metallurgy. Address: November 10, care Metal Finishing, 381 Broadway, Westwood, N. J.

INDEX TO VOLUME 57 — METAL FINISHING

JANUARY-DECEMBER, 1959

(Compiled by N. Hall, Technical Editor, and I. Oquendo, Equipment and News Editor)

In this index all material that appeared in the January through December 1959 issues of *Metal Finishing* is listed according to subject matter, with cross references where required. Following each listing will be found a letter indicating the manner in which the material was published, as follows:

- (S)—Shop Problem
- (R)—Recent Development
- (P)—Patent

- (M)—Manufacturers' Literature
- (B)—Book
- (L)—Letter to the Editor

- (A)—Abstract from Foreign Literature

Any reference not followed by a letter was a feature article. The numbers in the right-hand column refer to the month and page numbers; 6-85 means June issue, page 85, etc.

ABRASIVES, BELTS—See Polishing

ACID DIPPING—See Bright Dipping and Pickling

ADHESION

- Pores and Blistering of Plated Zinc Die Castings (A) 1- 71
- Delayed Blistering (S) 9- 90
- Wood and Watts Nickel (S) 10- 81
- Adhesion to Clean Metal Surface (S) 10- 81

AGITATION AND MIXING

- Paint Mixing Machine (R) 1- 76
- Mixer Bulletin (M) 2-108
- Paint Mixing Device (P) 3- 74
- Volumetric Paint Mixer (P) 3- 74
- Agitation Device (R) 4- 82

ALLOY PLATING

- Cobalt-Nickel Alloy Bath (P) 1- 68
- Copper and Brass Brightener (P) 1- 71
- Nickel-Iron-Zinc Alloy Bath (P) 2- 77
- Brighteners (P) 4- 80
- Stained Brass Plate (S) 6- 94
- Electrodeposition of Copper-Tin Alloys (P) 6- 98
- Zinc Analysis in Brass Solutions (S) 7- 75
- Electrodeposition of Chromium Alloys 8- 59
- Electroplated Gold-Copper Alloys (A) 8- 82
- Deposition of Chromium-Nickel Alloys (S) 9- 89
- Cheap Brass Finish (S) 10- 82
- Immersion Deposits on Aluminum (P) 10- 86
- Nickel-Iron Baths (S) 11- 84
- White Finishes (S) 11- 85
- Electroplated Coatings of Tin-Nickel Alloys and Their Recent Applications (A) 11- 90
- Plating on Aluminum (P) 12- 83
- Silver-Thallium Plated Alloys (A) 12- 88

ALUMINUM

- Dull Finish on Aluminum (S) 1- 65
- Coating for Aluminum (P) 1- 69
- Plating on Aluminum (P) 1- 70
- Stripping Chromium (S) 2- 74
- Anodizing Aluminum Coated Steel (P) 2- 77
- Corrosion Prevention of Aluminum (P) 2- 80
- Aluminum Etch Cleaner (R) 2- 84
- Booster for Caustic Soda (R) 2- 88
- Aluminum Etch (R) 2- 89
- Corrosion Resistant Finish for Aluminum (R) 2- 93
- Coloring Anodized Aluminum (S) 3- 71
- Conversion Coating Aluminum (P) 3- 73
- Continuous Anodizing (P) 3- 73
- Oscillograph Method for Testing Aluminum Oxide Coatings (A) 3- 78
- Dyeing Anodized Aluminum (S) 4- 75
- Chemical Polishing Aluminum (P) 4- 77
- Chromium Plating on Aluminum (P) 4- 78
- Aluminum Pigments (P) 4- 81
- Hard Chromium Plating of Aluminum (A) 4- 81
- Anodizing and Multi-Color Printing on Aluminum by the Silk-Screen Process (A) 5- 77
- Aluminum Bath (P) 5- 78
- Immersion Cadmium on Aluminum (P) 5- 80
- Chemical Polishing Aluminum (P) 5- 81

Possibilities of Boehmite Coatings on Aluminum for Practical Applications (A)

- Aluminum Finish (S) 5- 81
- Anodizing Aluminum (P) 6- 94
- Anodizing Aluminum (P) 6- 99
- Aluminum Coating Process (M) 6-100
- Finishing Aluminum (M) 6-123
- Process for Enameling Aluminum (P) 7- 77
- Chromate Coating Aluminum (P) 7- 78
- Conversion Coating Aluminum (P) 7- 78
- Phenomena Occuring During Electropolishing of Aluminum and Steel (A) 7- 80
- Finishing Aluminum Castings (S) 8- 74
- Investigations of Lacquer Coatings on Aluminum (A) 8- 82
- Surface Treatments for Aluminum (A) 8- 83
- Bulk Anodizing of Aluminum and Aluminum Alloy Parts (A) 8- 82
- Strip for Anodized Aluminum (R) 8- 91
- Electropolishing of Aluminum, Review and Literature Survey 8- 91
- Anodizing Aluminum (S) 9- 80
- Plating on Aluminum (S) 9- 89
- Pickling Aluminum (P) 9- 89
- Aluminum Conversion Coating (P) 9- 92
- Aluminum Treatments (R) 9- 93
- Finishes for Aluminum (M) 9-101
- Cleaning Aluminum (P) 9-123
- Plating on Aluminum (P) 10- 83
- Immersion Deposits on Aluminum (P) 10- 84
- Chemical Polishing Aluminum Silicon Alloys (R) 10- 86
- Gold-Colored Aluminum (R) 10- 90
- Preparing Aluminum for Anodizing (M) 10-114
- Anodizing Aluminum Strip (S) 11- 84
- Plating on Aluminum (M) 11-122
- Abrasive Finishing of Aluminum and Magnesium (M) 11-122
- Chemical Polish for Aluminum (M) 11-123
- Porosity Test for Anodized Aluminum (S) 12- 79
- Plating on Aluminum (P) 12- 83
- Behavior of Anodized Aluminum Surfaces — Wear Resistance (A) 12- 85
- Aluminum Tinning Process (R) 12- 99

ANALYSIS—See Testing

ANODES

- Anode Hook Sleeve (P) 1- 67
- Anodes and Plating Chemicals (M) 1- 95
- Composition and Application of Anodes 2- 48
- Lead Anode for Chromium Plating (P) 2- 78
- Anodic Behavior of Various Types of Nickel in Plating Baths (A) 2- 82
- Composition and Application of Anodes 3- 55
- Titanium Anode Hook (R) 3- 76
- Titanium Anode Hooks and Baskets (R) 4- 86
- Copper Plating Process (P) 5- 80
- Copper Purity (S) 6- 94
- Anode Basket (P) 7- 77
- Anode Anodes and Salts (M) 8- 95
- Roll-Top Zinc Anodes (R) 9- 96
- Anode Ball Baskets (R) 9-100
- Platinum-Group Metal Products (M) 9-120
- Anode and Rack Clamp (R) 10- 92

ANODIZING

- Anodizing Rack (R) 1- 74
- Anodizing Aluminum Coated Steel (P) 2- 77

Specific Gravity of Sulfuric Acid — Aluminum Sulfate Solutions

- Coloring Anodized Aluminum (S) 3- 66

- Continuous Anodizing (P) 3- 71

- Oscillograph Method for Testing Aluminum Oxide Coatings (A) 3- 72

- Anodic Protective Coating on Magnesium 3- 75

- Dyeing Anodized Aluminum (S) 4- 68

- Anodizing and Multi-Color Printing on Aluminum by the Silk-Screen Process (A) 4- 75

- Anodizing Spline (R) 4- 81

- Anodizing Spline (M) 4- 89

- Aluminum Finish (S) 5-109

- Anodizing Aluminum (P) 6- 94

- Anodizing Aluminum (P) 6- 99

- Anodic Coating Thickness Tester (R) 6-100

- Analysis of Sulfuric Anodizing Solutions 6-109

- Bulk Anodizing of Aluminum and Aluminum Alloy Parts (A) 6- 63

- Strip for Anodized Aluminum (R) 6- 83

- Anodizing Aluminum (S) 6- 91

- Gold-Colored Aluminum (R) 6- 99

- Preparing Aluminum for Anodizing (M) 10- 96

- Anodizing Aluminum Strip (S) 11- 84

- Porosity Test for Anodized Aluminum (S) 12- 79

- Behavior of Anodized Aluminum Surfaces — Wear Resistance (A) 12- 85

AUTOMATIC EQUIPMENT

Spray Decorating-Mask Washing Machine (R)

- 1- 76

Coating Conveyor for Panels (P)

- 1-107

Spray Coating Machine (P)

- 2- 76

Cleaning Machine (P)

- 2- 76

Spray Coating Machine (P)

- 2- 76

Spray Coating Method (P)

- 2- 76

Rack Loader and Unloader (P)

- 2- 78

Media Separator (R)

- 2- 88

Automatic Paint Spray Machine (R)

- 2- 89

Solution Replenisher (R)

- 2- 91

Cleaning and Finishing (M)

- 2-100

Apparatus for Galvanizing Pipe (P)

- 3- 73

Continuous Anodizing (P)

- 3- 73

Mechanical Timer for Spraying Machines (R)

- 3- 83

Overhead Conveyor (R)

- 3- 83

Finishing Systems (M)

- 3-108

Dry Chemical Feeder (M)

- 3-108

Overhead Conveyors (M)

- 3-109

Automatic Spray Gun for Airless Paint Spraying (R)

- 4- 93

Straight Line Polishing Conveyor (R)

- 4- 94

Automatic Barrel Plater (R)

- 4- 95

Plating Machine (P)

- 5- 78

Spray Washer (P)

- 5- 80

Automatic Processing Conveyor (R)

- 5- 82

Indexing Table (R)

- 5- 84

Automatic Barrel Equipment (M)

- 5-108

Finishing Equipment & Supplies (M)

- 5-110

Pipe Plating Machine (P)

- 6- 99

Spray Painting Machine (R)

- 6-114

Automatic Processing Conveyor (M)

- 6-123

Automatic Washer (R)

- 7- 82

Device for Coating a Traveling Sheet (P)

- 8- 76

Small Versatile Conveyor (R)

- 8- 84

Automatic Spray Gun (R)

- 8- 92

Bulk Bright Dipping

- 9- 70

Spray Painting Machine (P)

- 9- 91

Electroplating Machine (P)

- 9- 91

Paint Coating Machine (P)	9- 93
Apparatus for Coating Cavities (P)	9- 93
Feed Device for Continuous Plating Barrel (P)	9- 94
When to Consider Automatic Spray Equipment	10- 69
Automatic Cleaning and Pickling Layouts for Modern Surface Treatment (A)	10- 87
Barrel for Automatic Plating Machines (R)	10- 88
Automatic Spray Machine (R)	10- 90
Metal Processing (M)	10-116
Hot Dip Galvanizing (P)	11- 88
Wire Plating Machine (P)	11- 90
Automatic Spray Coater (R)	11- 95
Automatic Polishers (R)	12- 91
Automatic Washer (R)	12- 98
BAKING AND DRYING	
Basement Baking Ovens (S)	1- 66
Oven Temperature Control (R)	1- 82
Cabinet Ovens (R)	1- 86
Paint Baking Oven (P)	2- 79
Infra-Red Ovens (R)	2- 92
Spray Booths and Oven on Stilts Solve Space and Quality Problems	3- 64
Infra-Red Heating Element (R)	4- 90
Industrial Finishing Equipment (M)	4-117
Heat Processing Furnaces (M)	5-110
Infra-Red Oven (R)	6-121
Electric Oven (R)	6-122
Metal Cleaning-Heat Processing Equipment (M)	6-123
Cabinet Ovens (R)	8- 87
Infra-red Heater (R)	9-102
Process Drying (M)	9-122
Controlled Temperature Oven (R)	10- 88
Open Top Dryer (R)	11- 94
Infra Red Baking of Organic Finishes	12- 69
Oven Catalog (M)	12-101
BARREL FINISHING—See Tumbling	
BARREL PLATING	
Plating Barrel (P)	1- 68
Plating Barrel (P)	1- 69
Plating Barrel (R)	1- 89
Barrel Plating (P)	3- 73
Automatic Barrel Plater (R)	4- 95
Plugged Cylinder Perforations (S)	5- 76
Barrel Plating Cylinder (R)	5- 89
Automatic Barrel Equipment (M)	5-108
Electroplating Machine (P)	9- 91
Feed Device for Continuous Plating Barrel (P)	9- 94
Barrel Nickel Brightener (R)	10- 88
Barrel for Automatic Plating Machines (R)	10- 88
Switch for Barrel Plating (P)	11- 86
BLAST CLEANING	
Dull Finish on Aluminum (S)	1- 65
Preparation for Plating (P)	1- 68
Sand Blaster (R)	1- 89
Sand Blasting Apparatus (P)	1-107
Shot Blasting Chamber (P)	2- 76
Portable Blast Cleaning Machine (P)	2- 78
Sand Blast Machine (P)	4- 77
Sandblast Unit (R)	4- 94
Abrasive Blast Nozzle (R)	6-103
Automatic Wet-Blast Machine (R)	6-109
Abrasive Blast Unit (R)	6-120
Abrasive Blasting (M)	6-124
Abrasive Blasting (P)	7- 77
Vapor Blasting (P)	7- 78
Liquid Blasting (R)	8- 84
Liquid Blasting (M)	8- 98
Abrasive Separator (P)	9- 92
Centrifugal Abrasive Blasting (P)	9- 94
Dual Abrasive Blast Nozzle (P)	9- 94
Sandblast Nozzles (M)	9-118
Abrasive Blast Barrels (M)	9-121
Wet Blaster (R)	11- 98
Abrasive Blasting (M)	11-123
Abrasive Blasting Head (P)	12- 83
Shot Peening (M)	12-100
BRASS PLATING—See Alloy Plating	
BRIGHT DIPPING	
Chemical Polishing of Metals (P)	1- 67
Chrome Acid Dips for Copper and Brass (A)	3- 75
Chemical Polishing Aluminum (P)	4- 77
Pickling and Acid Dipping of Metals	5- 63
Chemical Polishing Aluminum (P)	5- 80
Bright Dipping Iron (S)	6- 95
Bulk Bright Dipping	9- 70
Chemical Polishing Aluminum Silicon Alloy (R)	10- 90
Chemical Polish for Aluminum (M)	11-123
BRIGHTENERS	
Nickel Plating Bath (P)	1- 70
Brightener (P)	1- 71
Copper and Brass Brightener (P)	1- 71
Bright Nickel (P)	2- 76
Bright Nickel (P)	2- 77
Acid Copper Brightener (P)	2- 78
Bright Copper Bath (P)	2- 79
Bright Copper Bath (P)	2- 80
Acid Tin Brightener (P)	3- 74
Bright Cadmium Plating (P)	4- 79
Bright Copper Plating (P)	4- 80
Brighteners (P)	4- 80
Bright Metal Plating (A)	5- 74
Hinrichsen Solution (S)	5- 77
Brighteners (P)	5- 77
Bright Nickel Plating (P)	5- 79
Bright Nickel (P)	5- 82
24K Acid Bright Gold (R)	5- 96
Bright Silver Finish (S)	6- 97
Acid-Copper Brightener (P)	6- 98
Bright Copper Plating Process (P)	6-102
Cyanide Copper Brightener (R)	6-106
Bright Gold Process (R)	7- 79
Bright Copper Bath (P)	7- 79
Bright Cyanide Zinc Bath (P)	8- 66
Bright, Non-Brittle Acid Copper Deposits	8- 75
Licorice in Tin Baths (S)	8- 77
Bright Copper Bath (P)	8- 79
Bright Copper Bath (P)	8- 80
Bright Gold (P)	9- 96
Bright Nickel Process (R)	9- 96
Zinc Brightener (R)	10- 83
Bright Nickel Bath (P)	10- 88
Barrel Nickel Brightener (R)	11- 86
Bright Nickel Bath (P)	11- 87
Bright Copper Bath (P)	12- 81
Bright Copper Process (R)	12- 90
BUFFING—See Polishing	
BURNISHING—See Tumbling	
CADMIUM PLATING	
Cadmium Plating (P)	1- 67
Chromate Coating for Cadmium and Zinc (R)	1- 80
Bright Cadmium Plating (P)	4- 79
Immersion Cadmium on Aluminum (P)	5- 78
Cadmium Electropolating (P)	8- 78
Cadmium Plating High Strength Alloy Steels	10- 76
CERAMIC COATINGS	
Porcelain Enamel Stripper (R)	1- 76
Protective Coating (P)	2- 78
Porcelain Enamelling (P)	4- 79
Process for Enameling Aluminum (P)	7- 77
Porcelain Enameling Gold (P)	7- 80
Vitreous Enameling (P)	8- 78
Vitreous Enameling (P)	8- 80
Porcelain Enamel for Aluminum (P)	9- 92
CHEMICAL POLISHING—Set Bright Dipping	
CHEMICALS AND PIGMENTS	
Science for the Coatings Technologist	1- 54
Science for Electroplaters	1- 62
Lead Sulfamate (S)	1- 65
Anodes and Plating Chemicals (M)	1- 95
Science for the Coatings Technologist	2- 65
Science for Electroplaters	2- 71
Improved Trichlorethylene (R)	2- 87
Booster for Caustic Soda (R)	2- 88
Aluminum Paint Stabilizer (R)	3- 81
Water Wash Compounds (R)	3- 86
Paint Booth Cleaning (R)	3- 87
Science for Electroplaters	4- 71
Rongalite Salt (S)	4- 75
Aluminum Pigments (P)	4- 78
Processing Chemicals (M)	4-117
Science for the Coatings Technologist	5- 59
Improved Pearl Essences	5- 65
Science for Electroplaters	5- 72
Pigmented Lacquers (P)	5- 78
Drier Accelerators (P)	5- 79
Organic Coating (P)	5- 79
Ethylene Amines (M)	5-108
Science for the Coatings Technologist	7- 65
Varnish Flattening Agent (P)	7- 78
Degreasing Agent (R)	7- 86
Health Legislation Concerning Paint Ingredients	8- 68
Water Displacing Liquid (R)	8- 90
Synthetic Pearl Pigment (R)	8- 92
Nickel Anodes and Salts (M)	8- 95
A Glossary of Pigments, Varnish and Lacquer Constituents (B)	8-109
Trichlorethylene (M)	10-116
Chemicals (M)	10-117
Science for the Coatings Technologist	11- 76
Magnesium-Zinc Paint Pigments (P)	11- 90
Water-Wash Spray Booth Additive (R)	11-100
Chemical Products (M)	11-123
CHROMIUM PLATING	
Effects of Impurities in a Bright Nickel Bath on the Covering Power of a Chromium Bath	1- 58
Plating on Aluminum (P)	1- 70
Activating Nickel Surfaces (P)	1- 70
Sulfite Determination in Chromium Plating Solutions	2- 59
Stripping Chromium (S)	2- 59
Lead Anode for Chromium Plating (P)	2- 78
Chromium Bath (P)	2- 79
Hard Chromium Plating in Locomotive Construction Practice (A)	2- 81
COPPER-NICKEL-CHROMIUM and Corrosion Protection	
Hard Chromium Plating (S)	3- 74
Chromic Bath Spray Depressant (P)	3- 74
Chromic Acid Mist Detector (R)	3- 82
Chromium Plating Services (M)	3-101
Chromium Plating on Aluminum (P)	4- 87
Economics of Hard Chromium Plating Practice with Locomotive Running Parts (A)	4- 88
Ductile Chromizing (P)	5- 78
Hard Chromium Process (R)	5- 85
Chromium Plating Zinc & Lead (P)	6- 99
Chromium Plating (P)	6-145
Blue Chromium (S)	7- 75
D-Chrom Bath (S)	7- 75
Plating on Molybdenum (P)	7- 79
New Method of Titrimetric Estimation of Sulfuric Acid in Chromium Plating Baths (A)	7- 80
Duplex Chromium Plate (R)	7- 82
Hard Chromium Plating of Engineering Parts (A)	9- 94
Chromium Plating of I.C. Engine Parts (A)	9- 94
Perous Chromium Plating of Piston Rings (A)	12- 85
Chromium Plating Chemicals (R)	12- 90
CLEANING	
Cleaning Stainless Steel (S)	1- 65
Mask Washing Machine (P)	1- 70
Spray Decorating-Mask Washing Machine (R)	1- 76
High Power Ultrasonic Cleaner (R)	1- 79
Blackening Salt Remover (R)	1- 84
Ultrasonic Cleaners (M)	1- 97
Cleaning Machine (P)	2- 64
Aluminum Etch Cleaner (R)	2- 88
Booster for Caustic Soda (R)	2- 90
Aluminum Etch (R)	2- 92
Ultrasonic Cleaner (R)	2-109
Cleaning and Finishing Machinery (M)	3- 71
Testing Ultrasonic Cleaners (S)	3- 73
Ultrasonic Cleaning Apparatus (P)	3- 73
Cleaning of Formed Sheet Parts by Ultrasonics (A)	3- 75
Cleaner-Phosphatizer (R)	3- 85
Ultrasonic Cleaning Systems (R)	3- 85
Buffing Compound Remover (R)	4- 82
Heated Ultrasonic Cleaning Tank (R)	4- 94
Spray Washer (P)	5- 80
Fingerprint Removal (S)	6- 98
Steam Cleaning Gun (P)	6- 98
Metal Cleaning Detergent (R)	6-104
Steam-Jet Cleaner (R)	6-105
Ultrasonic Cleaning Unit (R)	6-109
Ultrasonic Cleaners (R)	6-114
Test Meter for Cleaners (R)	6-118
Room-Temperature Cleaner (M)	6-123
Metal Cleaning-Heat Processing Equipment (M)	6-124
Metal Cleaning Guide (M)	7- 76
Plating Foli-Baked Stone Jewelry (S)	7- 77
Paint Brush Cleaning Tool (P)	7- 77
Cleaning-Phosphating Process (P)	7- 80
Ultrasonic Cleaner (A)	7- 82
Automatic Washer (R)	7- 82
Steel Electrocleaner (R)	7- 82
Acid Cleaner (R)	7- 84
Phosphating Cleaner (R)	7- 85
Ultrasonic Cleaning Equipment (M)	7- 85
Steam Cleaner (P)	8- 76
Ultrasonic Cleaner (R)	8- 84
Ultrasonic Cleaner Unit (R)	8- 89
Ultrasonic Cleaner (R)	9- 95
Steam Cleaning Hose (R)	9-100
Ultrasonic Cleaner (R)	9-102
Ultrasonic Cleaning (M)	9-119
Metal Cleaning (M)	9-120
Metal Cleaners (M)	9-120
Ultrasonic Cleaning (M)	10- 64
The Not-So-'ideal' Cleaning Cycle	10- 83
Cleaning Aluminum (P)	10- 87
Automatic Cleaning and Pickling Layouts for Modern Surface Treatment (A)	10- 93
Steam Cleaning Machine (R)	10- 96
Alkaline Cleaning Compound (R)	10- 96
Detergent Applicator (R)	10- 98
Electrocleaner (R)	10-114
Preparing Aluminum for Anodizing (M)	10-114
Metal Cleaning (M)	10-115
Metal Cleaners (M)	10-115
Ultrasonic Cleaning Unit (R)	11- 96
Buffing Compound Remover (R)	11- 96
Cleanliness Tester (R)	11- 96
Solvent Emulsion (R)	11- 96
Ultrasonic Cleaning (M)	11-123
Ultrasonic Cleaners (R)	12- 90
Ultrasonic Cleaning Spray Cleaner (R)	12- 93
Ultrasonic Cleaning Unit (R)	12- 95
Automatic Washer (R)	12- 98
Ultrasonic Cleaning (M)	12-100
COLOR BUFFING—See Polishing	
COLORED SURFACE TREATMENTS	
Finishing Bronze Plaques (S)	1- 66
Blackening Salt Remover (R)	1- 84
Blackening Silver (S)	3- 70
Standard Hardware Finishes (S)	3- 70
Coloring Anodized Aluminum (S)	3- 71
Black Nickel Plating (P)	3- 73

Producing Bronze Finish (S)	4- 75	Tarnishing of Copper Plate (S)	3- 70	Sheet Electroforming (P)	9- 91
Dyeing Anodized Aluminum (S)	4- 75	Copper Additive (M)	3-108	Electroforming Wave Guides (P)	9- 94
Anodizing and Multi-Color Printing on Aluminum by the Silk-Screen Process (A)	4- 81	Blistering (S)	4- 76	Electroforming Process (P)	9- 94
Gold Dye for Chromated Surfaces (R)	5- 86	Bright Copper Plating (P)	4- 79	Electroforming Screens (P)	10- 83
Die Dyeing of Finishes for Vacuum Metal- lizing	5- 87	Internal Stresses in Copper Deposits (A)	4- 81	Electroforming Copper Grids (P)	11- 88
Gold Colored Finish (S)	6- 94	Smutty Copper Deposits (S)	5- 74	Electroforming Sheets (P)	12- 83
Gold-Colored Metal (S)	6- 95	Copper Plating Process (P)	5- 80	Electroforming (P)	13- 83
Blue Gold Deposits (S)	6- 96	Copper Purity (S)	6- 94	Iron Electroforming (P)	12- 84
Blue Chromium (S)	7- 75	Acid-Copper Brightener (P)	6- 97		
Grey Finish on Nameplates (S)	8- 74	Bright Copper Plating Process (P)	6- 98		
Colored Conversion Films (M)	8- 96	Cyanide Copper Brightener (R)	6-102		
Gray-Nickel Bath (S)	9- 89	Science for Electroplaters	7- 72		
Cheap Brass Finish (S)	10- 82	Bright Copper Bath (P)	7- 79		
Gold-Colored Aluminum (R)	10- 96	Bright Copper Bath (P)	8- 66		
Antique Finish on Lead (S)	11- 85	Science for Electroplaters	8- 72		
Blackening Powdered Iron Compacts (S)	12- 80	Ductile Copper Deposits (P)	10- 84		
Blackening Copper Alloys (S)	12- 82	Science for Electroplaters	11- 80		
Black Oxide Finish for Steel (R)	12- 92	Bright Copper Bath (P)	11- 87		
COMPOSITIONS, BUFFING AND POLISHING					
Grease Stick (R)	1- 74	Electroless Copper (P)	11- 88		
Lime Buffing Compound (P)	4- 77	Electroforming Copper Grids (P)	11- 88		
Buffing Compound Remover (R)	4- 82	Science for Electroplaters	12- 75		
Buffing and Polishing Compounds (M)	5-107	Bright Copper (P)	12- 81		
Liquid Buffing Compositions (M)	9-118	Plating on Aluminum (P)	12- 83		
Liquid Buffing Compositions (M)	10-115	Bright Copper Process (R)	12- 90		
Buffing Compound Remover (R)	11- 96				
CONVERSION SURFACE TREATMENTS					
Paint Base Production (P)	1- 67	COSTS AND GENERAL			
Oxalate Conversion Coatings (P)	1- 68	Technical Developments of 1958	1- 38		
Phosphate Conversion Coatings (P)	1- 69	Rust Index of United States (M)	1- 89		
Coating for Aluminum (P)	1- 70	Slide Chart for Precious Metals Plating Costs (R)	1- 97		
Conversion Coating (P)	1- 74	Inventions and Patents	2- 87		
Chromate Coating for Zinc (R)	1- 78	Science for Electroplaters	3- 51		
Phosphate Coating (R)	1- 80	Science for Electroplaters	3- 67		
Chromate Coating for Cadmium and Zinc (R)	1- 80	Humidity and Rusting (S)	4- 71		
Testing Oxide and Phosphate Films (S)	2- 74	Economics of Hard Chromium Plating Practice with Locomotive Running Parts (A)	4- 75		
Phosphate Coating (P)	2- 77	Engineering Uses of Plated Coatings	4- 81		
Corrosion Prevention of Aluminum (P)	2- 80	Buffing Cost Analysis Form (M)	5- 48		
Corrosion Resistant Finish for Aluminum (R)	2- 93	Finishing Equipment and Supplies (M)	5-108		
Tarnishing of Copper Plate (S)	3- 70	Conversion Tables (M)	5-110		
Conversion Coating Aluminum (P)	3- 73	Institute of Metal Finishing Annual Con- ference	6-124		
Phosphating (P)	3- 73	Science for Electroplaters	7- 59		
Pickling-Coating Bath (P)	3- 74	Handbook of Practical Electroplating (B)	7- 72		
Conversion Coating Process (P)	3- 74	Metal Industry Handbook and Directory (B)	7-103		
Chemical Coating for Aluminum (P)	3- 74	Highlights of the A.E.S. Golden Jubilee Convention	7-108		
Oxide-Phosphate Coatings for Corrosion Protection of Iron and Zinc (A)	3- 75	Health Legislation Concerning Paint In- gredients	8- 50		
Cleaner-Phosphatizer (R)	3- 85	Perspiration Problems in Metal Finishing Techniques (A)	8- 68		
Anodic Protective Coating on Magnesium	4- 68	Plating Time Determinations	8- 82		
Vapor-Phase Corrosion Inhibition (P)	4- 78	Weights and Loads of Parts Made of Var- ious Metal Bars	9- 77		
Conversion Coatings (P)	4- 80	Finishing Processes (M)	9- 78		
Chromate Coatings (M)	4-117	Finishing Cost Guide (M)	9-120		
Conversion Coatings (S)	5- 75	Directory of New England Manufacturers (B)	9-122		
Conversion Coatings (P)	5- 77	Metal Finishing in Europe Today	11-112		
Oxalate Coatings (P)	5- 77	Do You Appreciate the Dilemma of Depre- ciation?	12- 54		
Phosphating Process (P)	5- 77	Plating Time Calculator (R)	12- 66		
Method of Passivating Silver (P)	5- 77	FIRST AID—See Safety Procedures and Equipment	12- 90		
Chromate Conversion Coating (P)	5- 78				
Phosphate Coating (P)	5- 78				
Possibilities of Boehmite Coatings on Aluminum for Practical Applications (A)	5- 79				
Gold Dye for Chromated Surfaces (R)	5- 81				
Phosphate Coating (P)	5- 86				
Conversion Coating Applicator (P)	5- 98				
Phosphate Coating (P)	5- 98				
Chromate Conversion Coating (R)	6-100				
Organic Finishing (M)	6-102				
Test for Chromate Coatings (S)	6-124				
Cleaning-Phosphating Process (P)	7- 76				
Chromate Coating Aluminum (P)	7- 77				
Conversion Coating Zinc (P)	7- 78				
Conversion Coating Aluminum (P)	7- 78				
Phosphating Clean (R)	7- 85				
Chromate Coating Magnesium (P)	7- 86				
Conversion Coating (P)	7- 87				
Oxalate Coatings (P)	7- 87				
Cold Phosphating (P)	7- 89				
Conversion Coating for Magnesium (P)	7- 89				
Surface Treatments for Aluminum (A)	7- 89				
Colored Conversion Films (M)	7- 96				
Aluminum Conversion Coating (P)	7- 93				
Conversion Coating (P)	7- 94				
Chromating Steel Strip for Corrosion Re- sistance (A)	7- 94				
Aluminum Treatments (R)	7- 95				
Corrosion Resistance Undercoat (M)	7- 95				
Surface Treatment of Zinc-Coated Steel Strip and Sheet (A)	7-123				
Cold Phosphating Process (R)	10- 95				
Conversion Coatings on Phosphate Films	11- 64				
Phosphating Process (P)	11- 82				
Phosphating Bath (P)	11- 88				
Sulfide Conversion Coating (P)	11- 89				
Low Temperature Phosphating Compound (R)	11- 95				
Corrosion Prevention-Magnesium (P)	12- 84				
COPPER PLATING					
Fumes from Copper Tank (S)	1- 65				
Preparation for Plating (P)	1- 68				
Brighteners (P)	1- 71				
Copper and Brass Brightener (P)	1- 71				
Acid Copper Brightener (P)	2- 78				
Bright Copper Bath (P)	2- 79				
Bright Copper Bath (P)	2- 80				
Copper-Nickel-Chromium and Corrosion Protection	3- 44				
Tarnishing of Copper Plate (S)	3- 70				
Copper Additive (M)	3-108				
Blistering (S)	4- 76				
Bright Copper Plating (P)	4- 79				
Brighteners (P)	4- 80				
Internal Stresses in Copper Deposits (A)	4- 81				
Smutty Copper Deposits (S)	5- 80				
Copper Plating Process (P)	5- 80				
Copper Purity (S)	6- 94				
Acid-Copper Brightener (P)	6- 97				
Bright Copper Plating Process (P)	6- 98				
Cyanide Copper Brightener (R)	6-102				
Science for Electroplaters	7- 72				
Bright Copper Bath (P)	7- 79				
Bright, Non-Brittle Acid Copper Deposits	8- 66				
Science for Electroplaters	8- 72				
Bright Copper Bath (P)	8- 77				
Electroforming (P)	8- 77				
Electroforming Apparatus (P)	8- 77				
Electroplating (P)	8- 77				
Electroplating Apparatus (P)	8- 77				
Electroplating Bath (P)	8- 77				
Electroplating Cells (P)	8- 77				
Electroplating Equipment (P)	8- 77				
Electroplating Grids (P)	8- 77				
Electroplating Materials (P)	8- 77				
Electroplating Process (P)	8- 77				
Electroplating Solutions (P)	8- 77				
Electroplating Tools (P)	8- 77				
Electroplating Units (P)	8- 77				
Electroplating Wave Guides (P)	8- 77				
Electroforming (P)	9- 94				
Electroforming Process (P)	9- 94				
Electroforming Screens (P)	10- 83				
Electroforming Copper Grids (P)	11- 88				
Electroforming Doll Molds (S)	12- 83				
Electrodeposited Mold (P)	12- 83				
Electroforming Process (P)	12- 83				
ELECTROPOLISHING					
Anodic Processes at Metal Electrodes with Electropolishing (A)	1- 73				
Electropolishing Solution (M)	1- 95				
Localized Electropolishing (P)	4- 79				
Electropolishing Uranium (P)	6- 97				
Electropolishing Molybdenum (S)	7- 75				
Phenomena Occuring During Electropolish- ing of Aluminum and Steel (A)	7- 80				
Electropolishing Solution (P)	8- 77				
Electropolishing Method (P)	8- 77				
Electropolishing of Aluminum, Review and Literature Survey	9- 80				
Electropolishing Bath (P)	9- 93				
Practical Aspects of Electropolishing Steel and Steel Alloy (A)	9- 95				
Electropolishing Method (P)	10- 84				
Electropolishing Process (M)	10-114				
Baths for Surface Finishing of Engine- ering Parts by Electropolishing (A)	11- 91				
Electropolishing (M)	12-100				
Brass Electropolish (M)	12-102				
ETCHING—See Pickling					
FILTERS AND PUMPS					
Air-Powered Pump (R)	1- 85				
Controlled Volume Pumps (M)	1- 96				
Carbon and Graphite (M)	1- 97				
Compressed Air Filters (M)	1- 97				
Wash-Off Filter Cartridge (R)	2- 86				
Engineering Equipment (M)	2-107				
Brush Holder and Filter (P)	3- 73				
Rotary Pumps (M)	3-110				
Portable Pumps (R)	4- 82				
Solution Filter (R)	4- 96				
Portable Filter (R)	5- 82				
Portable Solution Filter (R)	5- 86				
"Canned" Filter Pump (R)	6-102				
Solution Filter (R)	6-107				
High Vacuum Pump (R)	6-117				
Chemical Solution Feed Pump (R)	6-120				
Sump Filter Pump (R)	6-121				
Stainless Steel Filter (R)	6- 88				
High Vacuum Pumps (R)	6- 96				
Booster Vacuum Pumps (M)	9-101				
Porous Ceramic Filter Element (R)	9-118				
Pumps (M)	10- 97				
Filter Cartridge (R)	12- 94				
FIRST AID—See Safety Procedures and Equipment					
GAS PLATING					
Gas Plating (P)	1- 67				
Chromizing (P)	1- 69				
Gas Plating (P)	1- 70				
Gas Plating (P)	1- 72				
Gas Plating (P)	4- 77				
Ductile Chromizing (P)	5- 78				
Chromizing (P)	6- 99				
Gas Plating (P)	7- 78				
Experience with Corrosion-Resistant Chro- mized Steel Bolts (A)	8- 82				
Gas Plating (P)	9- 93				
Gas Plating (P)	11- 89				
Gas Plating (P)	12- 84				
GENERATORS—See Power Supplies					
GRINDING—See Polishing					
HANDLING EQUIPMENT					
Portable Acid Handling Unit (R)	1- 78				
5-Gallon Safety Can (R)	1- 84				
Canvas Tote Baskets (R)	1- 88				
Overhead Cable Conveyors (M)	1- 96				
Rack Loader and Unloader (P)	2- 78				
Basket Plating Apparatus (P)	2- 79				
Media Separator (E)	2- 88				
Solution Replenisher (R)	2- 91				
Belt Conveyors (R)	2- 93				
Overhead Conveyor (R)	2- 93				
All-Purpose Hand Trucks (R)	2- 97				
Dry Chemical Feeder (M)	3- 108				
Overhead Conveyors (M)	3-109				
Liquid Chemical Feeder (R)	4- 86				
Plating Machine (P)	5- 78				
Small Versatile Conveyor (R)	5- 84				
Handling and Power Equipment (M)	5-120				
Cable Conveyors (M)	9-122				
Perforated Tumbling Barrels (R)	10-115				
Belt Conveyor (M)	11- 86				
Paint Can Attachment (P)	11- 86				
Paint Mixing Tool (P)	12- 83				
HEATING AND COOLING					
House-Type Paint Heater (P)	1- 67				
Portable Paint Heater (R)	1- 80				

Immersion Electric Heater (R)	1- 81
Electric Immersion Heaters (R)	1- 87
Electric Steam Generator (R)	1- 89
Cooling Coils (M)	1- 96
Electric Strip Heaters (M)	1- 96
Heating and Cooling Coils (M)	1- 96
Carbon and Graphite (M)	1- 97
Temperature Control (M)	1- 97
Paint Heater (R)	2- 90
Platecoil Heat Transfer Unit (R)	2- 81
Immersion Heater (M)	3-109
Pneumatic Temperature Controls (M)	3-109
Temperature Instruments (M)	3-109
Graphite Heat Exchanger (M)	3-109
Thermometer Wells (M)	3-109
Temperature Control Valves (R)	4- 87
Drum-Warmer (R)	4- 89
Infra-Red Heating Element (R)	4- 90
Platecoil Technical Data Manual (M)	4-117
Temperature Indicating Controller (M)	4-118
Temperature Controls (M)	5-109
Heat-Transfer Units (M)	6-112
Impervious Graphite Heat Exchangers (R)	6-115
Gas Fired Immersion Tank Heater (R)	6-118
Tantalum Bayonet Heaters (R)	6-124
Ventilation and Heat Transfer Equipment (M)	6-124
Plate-Coil Work Sheets (M)	7- 98
Heat Exchanger (M)	8- 96
Electric Heater (M)	8- 96
Graphite Heat Exchangers (M)	8- 97
Air Heaters (M)	9-121
Radiant Heater (R)	11- 98
HOT DIP COATINGS	
Hot Galvanizing Nails (S)	1- 65
Anodizing Aluminum Coated Steel (P)	2- 77
Influence of Steel Quality on Thickness of Coating in Hot Galvanizing (A)	2- 82
Lead Additions in Hot-Dip Galvanizing (A)	2- 82
Influence of Steel Structure on Hot Galvanizing (A)	2- 83
Apparatus for Galvanizing Pipe (P)	2- 83
Hot Dip Galvanizing (S)	2- 83
Hot Dip Galvanizing (P)	3- 75
Relative Advantages of Wet and Dry Hot-Dip Galvanizing Processes (A)	4- 79
The Cook-Norteman and Sendzimir Hot-Dip Galvanizing Processes (A)	4-100
The Sendzimir and Cook-Norteman Continuous Hot-Dip Galvanizing Process for Steel Sheet (A)	4-101
Hot Dip Galvanizing (P)	5- 81
Hot Dipping Steel Tubing (P)	11- 88
Hot-Dip Tinning of Cast Iron (A)	11- 89
Modern Developments with Hot-Dip Tinning in Industry (A)	12- 84
HYDROGEN EMBRITTLEMENT	
Embrittlement in Bright Nickel Coatings (A)	5- 80
Cadmium Plating High Strength Alloy Steels	10- 76
Embrittlement of Steel due to Pickling and Electroplating Treatments (A)	11- 90
IMMERSION PLATING	
Electroless Nickel (P)	1- 69
Immersion Gold (P)	1- 69
Electroless Nickel (P)	1-107
Electroless Nickel Plating of Carbon	2- 64
Immersion Lead Bath (P)	2- 80
Electroless Nickel — Maintenance of pH (A)	2- 83
Electroless Nickel (P)	4- 77
Plating Printed Circuits (P)	4- 78
Electroless Cobalt Plating (A)	4- 80
Immersion Cadmium on Aluminum (P)	4- 80
Electroless Gold Process (R)	4- 85
Electroless Nickel and Cobalt (P)	10- 84
Immersion Deposits on Aluminum (P)	10- 86
Immersion Plating on Zircaloy-2	11- 65
Immersion Deposits (P)	11- 86
Electroless Nickel (P)	11- 87
Electroless Copper (P)	11- 88
Electroless Nickel (P)	11- 89
Electroless Nickel (S)	12- 79
Surface Characteristics of Catalytic Nickel Coatings (A)	12- 88
Characteristic of Chemical Nickel Coatings (A)	12- 89
INHIBITORS	
Corrosion Inhibitor (P)	1- 70
Pickling Inhibitors (S)	8- 74
Acid Inhibitor (P)	8- 79
Acid Inhibitor (R)	10- 91
Pickling Inhibitor (P)	11- 88
Pickling Inhibitor (R)	11- 98
INSTRUMENTS, INDUSTRIAL	
Temperature Control (M)	1- 97
Pneumatic Temperature Controls (M)	3-109
Temperature Instruments (M)	3-109
Thermometer Wells (M)	3-109
Temperature Control Valves (R)	4- 87
Paint Drying Time Tester (R)	4- 90
Magnetic Flowmeter (M)	4-118
Temperature Indicating Controller (M)	4-118
Temperature Controls (M)	4-118
Test Meter for Cleaners (R)	6-118
Indicator and Indicating Controller (R)	6-119
Viscosity Control (M)	7- 97
Automatic Viscosity Control (M)	9-121
Viscosity Control (M)	9-122
Electric Indicators and Controllers (M)	11-123
Electrolytic Conductivity Meter (R)	12- 95
IRON PLATING	
Structure and Wear Resistance of Electro-deposited Ferrous Coatings	10- 72
Iron Electroforming (P)	12- 84
LEAD PLATING	
Lead Sulfamate (S)	1- 65
Immersion Lead Bath (P)	2- 80
Thickness Measurement of Tin and Lead Castings (A)	12- 88
LEVELLING	
Science for Electroplaters	8- 72
MAGNESIUM	
Anodic Protective Coating on Magnesium	4- 68
Conversion Coating Applicator (P)	6- 98
Chromate Coating Magnesium (P)	8- 76
Conversion Coating for Magnesium (P)	8- 80
Abrasive Finishing of Aluminum and Magnesium (M)	11-122
Corrosion Prevention-Magnesium (P)	12- 84
MASKS	
Mask Washing Machine (P)	1- 70
Spray Decorating-Mask Washing Machine (R)	1- 76
Silk Screens (R)	1- 86
Spray Decorating Equipment (M)	1- 96
Paint Spray Mask (P)	2- 77
Paint Spray Masks (P)	8- 78
Masking Tapes (M)	9-120
METALIZING	
Plating on Plastics (P)	1- 68
Electroforming Doli Molds (S)	2- 74
Rongalite Salt (S)	4- 75
Plating Non-Conductors (P)	4- 77
Plating Printed Circuits (P)	4- 78
Conducting Silver Ink (P)	5- 78
Vacuum Metallizing Quartz (P)	6-100
Gold Plated Printed Circuits (P)	8- 76
Silvering Process and Materials (P)	10- 83
Plating Non-Conductors (P)	10- 84
Printed Circuits (P)	10- 84
Metallizing Non Conductors (P)	12- 83
NICKEL PLATING	
Hard Nickel Plating in Russia	1- 52
Effects of Impurities in a Bright Nickel Bath on the Covering Power of a Chromium Bath	1- 52
Electroless Nickel (P)	1- 58
Nickel Plating Bath (P)	1- 69
Activating Nickel Surfaces (P)	1- 70
Brighteners (P)	1- 70
Electroless Nickel (P)	1- 71
Electroless Nickel Plating of Carbon	1-107
Bright Nickel (P)	2- 64
Bright Nickel (P)	2- 76
Dull Nickel Bath (P)	2- 77
Anodic Behaviour of Various Types of Nickel in Plating Baths (A)	2- 80
Electroless Nickel — Maintenance of pH (A)	2- 82
Copper-Nickel-Chromium and Corrosion Protection	2- 83
Black Nickel Plating (P)	3- 44
Nickel Plating (M)	3- 73
Electroless Nickel (P)	3-109
Plating Printed Circuits (P)	4- 77
Plating on Uranium (P)	4- 78
Brighteners (P)	4- 79
Hinrichsen Solution (S)	4- 80
Bright Nickel Plating (P)	5- 74
Bright Nickel (P)	5- 77
Embrittlement in Bright Nickel Coatings (A)	5- 79
Plating on Molybdenum (P)	5- 80
Nickel Anodes and Salts (M)	7- 79
Gray-Nickel Bath (S)	8- 95
Bright Nickel Process (R)	8- 95
Nickel Plating Specifications (S)	9- 96
Wood and Watts Nickel (S)	10- 81
Bright Nickel Bath (P)	10- 82
Barrel Nickel Brightener (R)	10- 83
Nickel Sulfamate Solutions (S)	11- 84
Bright Nickel Bath (P)	11- 86
Electroless Nickel (P)	11- 87
Electroless Nickel (P)	11- 89
Control of Watts Nickel Baths	12- 74
Purification of Nickel Bath (S)	12- 79
Electroless Nickel (S)	12- 79
Plating Over Passive Nickel (S)	12- 80
Ductile Nickel Deposits (P)	12- 81
Thick Nickel Electroplated Deposits — A Remedy for Fretting Corrosion (A)	12- 83
Surface Characteristics of Catalytic Nickel Coatings (A)	12- 88
Hardness Characteristics of Nickel Coatings (A)	12- 88
Characteristics of Chemical Nickel Coatings (A)	12- 89
ORGANIC COATINGS CORROSION RESISTANT	
Corrosion Preventive (P)	1- 68
Corrosion Preventive (P)	1- 69
Protective Coating for Tin Plate (P)	1- 76
Corrosion Inhibitor (P)	1- 78
Hot Spray Vinyl Coating (R)	2- 91
Organic Finish (R)	2- 94
Organic Coatings (M)	3-110
Corrosion Preventive (P)	5- 79
Corrosion Resistant Coatings (M)	5-109
Protective Coating (P)	6-100
Protective Coating (R)	6-119
Rust Preventive (M)	6-125
Corrosion Inhibiting Coating (P)	7- 78
Organic Coating (P)	7- 79
Rust Preventive Composition (P)	7- 80
Rust Protection by Lanolin Coatings (A)	7- 80
Rust Preventive (R)	7- 88
Emulsifiable Rust Preventive Concentrate (P)	8- 78
Corrosion Preventive (P)	8- 80
Multicolor Coatings for Corrosion Protection	9- 78
Cover Paint (P)	9- 91
Rust Preventive (M)	9-119
Maintenance Coatings (M)	9-121
Protective Coatings (M)	9-122
Rust Inhibiting Composition (P)	11- 86
Rust Preventive (P)	11- 88
One-Coat Protective Coating (R)	12- 95
Protective Coating (R)	12- 98
ORGANIC COATINGS DECORATIVE AND SPECIAL	
Latex Paint (P)	1- 70
Vinyl Wrinkle Finishes (R)	1- 84
Texture Coating (R)	1- 86
Organic Coating System (P)	3- 74
Alkyd Enamel (R)	3- 79
Wrinkle Coating (P)	4- 79
Vinyl Wrinkle Finishes (M)	4-117
Improved Pearl Essences	5- 68
Pearlescent Type Coating Composition (P)	5- 78
Organic Coating (P)	5- 80
Polyethylene Dispersion Coating (R)	5- 84
The Pentaerythritol Alkyd and Modified Alkyd Finishes (A)	9- 95
Paint Color Chart (M)	10-117
Alkyd Resin Coating (P)	11- 86
Organic Finish (P)	11- 86
Organic Coating (P)	11- 87
Cementiferous Paints (P)	11- 87
Self-Hardening Surface Coating Compositions (P)	11- 87
Organic Coating (P)	11- 89
Paint Base (P)	11- 89
Air-Drying, Unsaturated Polyester Resins for Lacquer Finishes (A)	11- 91
Hot Organic Coatings (B)	11-112
Organic Coating Material (P)	12- 81
Tinting Bases for Both Oil and Water-ducible Paints (P)	12- 81
Thermosetting Coating Compositions (P)	12- 84
Colored Organic Finishes (M)	12-102
ORGANIC COATINGS HEAT RESISTANT	
Heat-Resisting Paint (M)	2-109
Silicone Resin Ceramic Paint (P)	3- 72
Heat Resistant Coatings (M)	3-109
ORGANIC COATINGS LACQUER	
Pigmented Lacquers (P)	5- 78
Organic Coating Composition (P)	5- 79
Light-Fast Colored Lacquers (P)	6- 97
Organic Coating (P)	7- 79
Gold-Dye Brass Lacquer (S)	8- 74
Investigations of Lacquer Coatings on Aluminum (A)	8- 82
ORGANIC COATINGS METALLIC	
Aluminum Pigmented Coating (P)	3- 72
Aluminum Paint Stabilizer (R)	3- 81
Organic Coating (P)	5- 79
Organic Finishes (R)	8- 91
Zinc-Rich Coating (R)	8- 92
Zinc-Rich Protective Coating (M)	8- 96
Aluminum Paint (R)	9- 99
ORGANIC COATINGS MISCELLANEOUS	
Organic Finishing Developments of 1958	1- 48
Science for the Coatings Technologist	1- 54
Paint Competition (P)	6-100
Reducer for Baking Enamels (R)	6-105
Protective Coatings (R)	6-116
Aerosols (M)	8- 97
A Glossary of Pigments, Varnish and Lacquer Constituents (B)	8-109
ORGANIC COATINGS ORGANIC COATING APPLICATION	
Dipping and Flow Coating Methods	1- 61
Adjustable Paint Brush (P)	1- 68
Roller Brush Splash Guard (P)	1- 68
Paint and Lacquer Dispenser (P)	1- 68
Paint Roller (P)	1- 70

Cleaning and Painting (R)	1-77	Strippable Vinyl Coatings (M)	2-108	Steam Cleaning Hose (R)	9-100
Paint Spray Gun (R)	1-81	How to Specify a Painted Finish	3-60	Spray Nozzles (R)	9-100
Silk Screens (R)	1-86	Improved Fluorescent Paints Expand Their Engineering Uses	3-62	Steam Specialties (M)	9-121
Spray Decorating Equipment (M)	1-96	Etch Primer and Top Coat (P)	3-72	Coated Valves (M)	9-122
Coating Conveyor for Panels (P)	1-107	Air-Dry Organic Coating (P)	4-97	Automatic Drain Trap (R)	10-91
Spray Coating Machine (P)	1-107	Water-Dispersed Organic Coating (P)	4-97	Hollow Cone Spray Nozzle (R)	10-95
Toughening Up Operations (S)	2-75	Light-Fast Colored Lacquers (P)	4-97	Self-Cleaning Pipeline Strainer (M)	11-122
Spray Coating Machine (P)	2-76	Water Emulsion Paint (P)	6-99	Industrial Spray Nozzle (R)	12-98
Spray Coating Method (P)	2-79	Science for the Coatings Technologist	7-65		
Spray Gun for Pipe Interiors (P)	2-80	Varnish Flattening Agent (P)	7-78		
Spray Gun Attachment (P)	2-80	Phosphorescent Paints (R)	7-86		
Electrostatic Coating (P)	2-80	Thixotropic Coating Compositions (P)	8-76		
Spray Gun (P)	2-80	Solvent-Coating Process (P)	8-78		
Automatic Paint Spray Machine (R)	2-80	In Situ Polyamide Coating Method (P)	8-78		
Airless Spray Coating (M)	2-80	Thermosetting Coating (M)	9-92		
Brush Holder and Filter (P)	2-80	Crackle Finish (P)	9-92		
Extension Handle for Paint Rollers (P)	2-80	Plastic Coating Process (R)	9-98		
Paint Feed Tank (P)	2-80	Synthetic Rubber Latex Finishes for Metals (A)	10-86		
Airless Paint Spray Gun (P)	2-80	Science for the Coatings Technologist	11-76		
Water Wash Compounds (R)	2-80	Organic Coating (P)	12-84		
Paint Booth Coating (R)	2-86				
Air Dryer and Receiver (R)	2-87				
Finishing Systems (M)	2-87				
Spray Paint Equipment (M)	2-108				
Electrostatic Coating (P)	4-77				
Spraying Method (P)	4-78				
Expendable Plant Applicator (P)	4-79				
Pouring Spout and Strainer for Paint Can (P)	4-79				
Circulating Fluid Regulators (R)	4-88				
Automatic Spray Gun for Airless Paint Spraying (R)	4-98				
Industrial Finishing Equipment (M)	4-117				
Flow Coater (M)	4-118				
Advantages of Spraying with Heated Materials	5-70				
Hot Spraying Lacquers (S)	5-70				
"Fogging" (S)	5-74				
Electrostatic Spraying (P)	5-75				
Roller Coaters and Graining Machines (M)	5-78				
Sound and Color Movie on Electrostatic Hand Gun (M)	5-108				
Brush Cleaner and Dryer (P)	6-97				
Paint Applicator (P)	6-98				
Spraying Apparatus (P)	6-99				
Brush Holder Attachment (P)	6-99				
Electrostatic Spraying (P)	6-99				
Paint Drip Tray (P)	6-99				
Spray Painting Machine (R)	6-114				
Cup-Type Spray Gun (R)	6-117				
Hydrostatic Spraying of Organic Finishes	7-70				
Cratering (S)	7-75				
Electrostatic Coating (P)	7-78				
Testing Apparatus for Electrostatic Coating Material (P)	7-79				
Electrostatic Spray Process (P)	7-80				
Paint Heater Hose (R)	7-86				
Hot Spray System (R)	7-86				
Roller Coater (R)	7-87				
Roller Coater (R)	7-88				
Device for Coating a Traveling Sheet (P)	8-76				
Spraying Apparatus (P)	8-79				
Spray Gun (P)	8-79				
Spray Guns for Spraying Two or More Materials (P)	8-79				
Airless Spray System (R)	8-87				
Hand Welder for Plastics (R)	8-90				
Spray Gun Conditioner (R)	8-90				
Automatic Spray Gun (R)	8-92				
Hand Welder for Plastics (M)	8-95				
Paint Finishing (M)	8-97				
Traveling Booth for Spraying Railroad Cars	9-68				
Electrostatic Spray Coating System (P)	9-91				
Spray Painting Machine (P)	9-91				
Spray Gun (P)	9-92				
Paint Coating Machine (P)	9-93				
Apparatus for Coating Cavities (P)	9-93				
Spray Gun (P)	9-93				
Spray System (P)	9-93				
Decorative Paint Stripper (R)	9-103				
Fluidized Bed Coater (R)	9-104				
Paint Spray Equipment (M)	9-123				
When to Consider Automatic Spray Equipment	10-69				
Fluidized Bed Coating	10-74				
Electrostatic Coating (P)	10-83				
Two-Roll Paint Applicator (P)	10-84				
Automatic Spray Machine (R)	10-90				
Electrostatic Spraying (P)	11-87				
Automatic Spray Coater (R)	11-95				
Curtain-Type Coating Machine (R)	11-97				
Paint Spray Unit (R)	11-99				
Water-Wash Spray Booth Additive (R)	11-100				
Electrostatic Coating (P)	12-81				
Resin Gun (P)	12-81				
Reciprocating Spraying Apparatus (P)	12-81				
Automatic Painting, Wiping, and Polishing Machine (P)	12-82				
Method of Applying Pigmented Coating to Sheet Metal (P)	12-82				
Electrostatic Coating Method (P)	12-82				
Organic Coating Application (P)	12-83				
Spray Gun (P)	12-84				
Paint Spray Gun (P)	12-84				
Finishing Systems (M)	12-100				
Plastic Coating Process (M)	12-101				
ORGANIC COATINGS SPECIAL PURPOSE					
Red Lead Composition (P)	1-69				
Mildew Resistant Paint Composition (P)	1-70				
Phenolic/Vinyl Coating Process (R)	1-78				
Epoxy Resin Finish (M)	1-96				
Epoxy Spray Coat System (M)	1-97				
Nitrocellulose Coating (P)	1-107				
Stabilized Varnishes (P)	2-76				
STRIPPABLE VINYL COATINGS (M)	3-108				
How to Specify a Painted Finish	3-60				
Improved Fluorescent Paints Expand Their Engineering Uses	3-62				
Etch Primer and Top Coat (P)	3-72				
Air-Dry Organic Coating (P)	4-97				
Water-Dispersed Organic Coating (P)	4-97				
Light-Fast Colored Lacquers (P)	4-97				
Water Emulsion Paint (P)	6-99				
Science for the Coatings Technologist	7-65				
Varnish Flattening Agent (P)	7-78				
Phosphorescent Paints (R)	7-86				
Thixotropic Coating Compositions (P)	8-76				
Solvent-Coating Process (P)	8-78				
In Situ Polyamide Coating Method (P)	8-78				
Thermosetting Coating (M)	9-92				
Crackle Finish (P)	9-92				
Plastic Coating Process (R)	9-98				
Synthetic Rubber Latex Finishes for Metals (A)	10-86				
Science for the Coatings Technologist	11-76				
Organic Coating (P)	12-84				
ORGANIC COATINGS STRIPPAGE					
Hot Dip Plastic Coating (R)	4-103				
Strippable Coating (R)	8-91				
Strippable Coatings (M)	8-98				
ORGANIC COATINGS WOOD					
Wrinkle Coating (P)	6-97				
OXIDIZING—See Colored Surface Treatments					
PHOSPHATE COATINGS—See Conversion Surface Treatments					
PICKLING AND DESCALING					
Plating on Uranium (P)	1-69				
Regeneration of Spent Pickle Liquors (P)	1-71				
Mat Dip Bath for Brass and Tombac Alloy (A)	2-83				
Exhaust for Hydrofluoric Dip (S)	3-70				
Pickling-Coating Bath (P)	3-74				
Chrome Acid Dips for Copper and Brass (A)	3-75				
Fluoride Pickling Compound (R)	3-78				
Non-Acid Deruster (R)	3-80				
Pickling Waste Treatment (P)	4-78				
Pickling Uranium (P)	4-78				
Scale Remover (P)	4-78				
Pickling and Acid Dipping of Metals	5-63				
Pickling Solution Analysis (S)	5-74				
Pickling Refractory Metals (P)	6-100				
Electropickling Process (P)	7-79				
Acid Cleaning Composition (P)	7-79				
Acid Cleaner (R)	7-84				
Pickling Inhibitors (S)	8-74				
Pickling Titanium (P)	8-76				
Descaling Refractory Metals (P)	8-78				
Molten Salt Bath Cleaning (P)	8-79				
Acid Inhibitor (P)	8-79				
Pickle for Copper and Silver (M)	8-95				
Pickle Analysis (S)	9-90				
Reclaiming Pickling Wastes (P)	9-91				
Pickling Aluminum (P)	9-92				
Waste Pickle Treatment (P)	9-92				
Pickling and Coating Stainless Steel (P)	9-93				
Aluminum Treatments (R)	9-101				
Chemical Deburring Solution (M)	9-118				
Automatic Cleaning and Pickling Layouts for Modern Surface Treatment (A)	10-87				
Acid Inhibitor (R)	10-91				
Pickling Inhibitor (P)	11-88				
Pickling Titanium and Zirconium (P)	11-89				
Embrittlement of Steel due to Pickling and Electropolishing Treatments (A)	11-90				
Pickling Inhibitor (R)	11-98				
Pickling Waste Recovery (P)	12-81				
Acid Pickling (P)	12-82				
Pickling Cobalt-Nickel-Iron Alloys (P)	12-82				
Descaling Zirconium (P)	12-83				
Powdered Pickling Compounds (M)	12-101				
PIPINGS AND FITTINGS, NOZZLES, VALVES					
Graphite Pipe and Fittings (R)	1-80				
Spray Nozzle Connector (R)	1-80				
Plastic Gate Valves (R)	1-82				
Air Blow Gun (R)	1-82				
High Capacity Spray Nozzles (R)	1-86				
Bell and Spigot Joint (R)	2-88				
Impervious Graphite Pipes (M)	2-108				
PVC Expansion Joint (R)	3-83				
Plastic Valves (M)	3-110				
PVC Flange Union Assembly (R)	4-86				
Large Size Adjustable Joints (R)	4-87				
Temperature Control Valves (R)	4-87				
Spray Nozzle for Close Quarters (R)	4-88				
Air Compressor Tank Drain (R)	4-89				
Plastic Pipeline Strainers (R)	4-96				
Graphite Globe Valves (R)	4-97				
Industrial Nozzles (M)	4-118				
Paint Heater Hose (R)	7-86				
Atomizing Nozzles (R)	7-87				
Industrial Spray Nozzle (R)	7-88				
PVC Relief and Back Pressure Valves (R)	8-93				

PLANT PRODUCTION METHODS

Electroplating Apparatus (P)	1-67			
Plating Printed Circuits (P)	1-67			
Blistering on Nickel-Silver (S)	3-70			
Plating Piston Rings (P)	3-74			
Plating Porous Metals (P)	3-74			
Humidity and Rusting (S)	4-75			
Chromic Plating on Aluminum (P)	4-77			
Plating on Uranium (P)	4-79			
Plating Bath Control (P)	6-97			
Method of Jet Plating (P)	6-98			
Printed Circuit Production (P)	6-98			
Plating on Inconel	7-64			
Plating Foil-Backed Stone Jewelry (S)	7-76			
Plating Method (P)	7-77			
Plating Interior Surfaces (P)	7-78			
Plating on Molybdenum (P)	7-79			
Plating on Aluminum (S)	9-89			
Abrasive Separator (P)	9-92			
Selective Plating (M)	9-122			
"Close-Plating" — A Page from the Past	10-62			
Plating on Aluminum (P)	10-84			
Plating on Uranium (S)	11-84			
Jet Plating (P)	11-87			
Method of Electrodepositing Metals (P)	11-87			
Plating on Aluminum (M)	11-122			
Abrasive-Bearing Electrodeposits (P)	12-82			
Printed Circuits Plating (M)	12-101			

PLASTICS—See Organic Coatings and Metallizing

PLATING MISCELLANEOUS METALS				
Electroless Cobalt Plating (A)	4-89			
Brighteners (P)	5-77			
Science for Electropolishers	6-90			
Iridium Deposition (S)	6-94			
Tungsten Plating from Aqueous Solutions (A)	6-101			
Plating Time Determinations	9-77			
Weights and Loads of Parts Made of Various Metal Bars	9-78			
Finishing Processes (M)	9-123			
Finishes for Aluminum (M)	9-123			
Bismuth Plating (S)	10-81			
Beryllium Oxide Coatings (S)	10-81			
Immersion Plating on Zircaloy-2	11-68			
Embrittlement of Steel due to Pickling and Electropolishing Treatments (A)	11-90			
Flexible Abrasive Head (M)	12-109			
Flexible Abrasive Wheel (P)	13-72			
Abrasive Drum (P)	13-73			
Belt Polishing Head (R)	13-79			
Abrasive Polishing Wheel (R)	13-80			
Grinding Wheel (M)	13-108			
Coated Abrasives (M)	13-109			
Rotary Brush (P)	14-77			
Spindle Type Finishing Equipment (R)	14-84			
Expanding-Type Abrasive Cone (R)	14-93			
Straight Line Polishing Conveyor (R)	14-94			
Coated Abrasive Discs (M)	14-118			
Buffing Small Parts (S)	15-74			
Anti-Slaking Buffing Compositions (P)	15-77			
Indexing Table (R)	15-84			
Table Type Polisher (R)	15-87			
Spindle Finishing Machines (R)	15-108			
Buffing Coat Analysis Form (M)	16-77			
Better Buffing Thru Better Buff Design	16-104			
Aluminum Finish (S)	16-108			
Centerless Belt Polisher (R)	16-108			
Coated Abrasives (R)	17-86			
Belt Polishers (R)	17-86			
Lightweight Swing Grinder (R)	17-113			
Abrasive Products (M)	18-124			
Surface Finishing Stainless Steels	18-48			
Better Buffing Thru Better Buff Design	18-54			
Polishing Belts (P)	18-75			
Flat Polisher (R)	18-85			
Buffing Wheel (R)	18-86			
Bonded Abrasive Discs (R)	18-86			
Buffing Gold Plate (S)	18-74			
Contact Wheel (P)	18-80			
Belt Grinding Machine (R)	18-93			

Position Indicator for Polishing and Buffing Heads (R)	9- 99	RACK AND RACK COATINGS	
Abrasive Wheels (R)	9-108	Anodizing Rack (R)	1- 74
Buffs and Polishing Wheels (M)	9-119	Plating Rack (P)	2- 78
Metal Buffing (M)	9-119	Plating Spline (R)	4- 79
Rubber-Bonded Abrasives (M)	9-119	Anodizing Spline (R)	4- 89
Metal-Bonded Abrasive Wheels (S)	10- 82	Anodizing Spine (M)	5-109
Flexible Abrasive Wheel (P)	10- 84	Rack Stripping Gun (R)	6-102
Belt Polisher (R)	10- 88	Anode Rack for Plating Cylinders (P)	6-146
Buffing Wheel (R)	10- 89	Plating Rack (P)	7- 77
Oscillating Platform for Polishing Heads (R)	10- 92	Anode and Rack Clamp (R)	10- 92
Gobel Buff (R)	10- 94	Holding Fixtures (R)	10- 93
Buff Cloth Production	10-115	Work Holding Process (R)	11- 92
Buffing Wheel Wear Compensator (R)	11- 92	RECOVERY AND PURIFICATION METHODS	
Sheet Polishers (R)	11- 92	Chromium Removal from Plating Baths (P)	1- 67
Abrasive Wheel (R)	11- 94	Engineering Equipment (M)	2-107
Belt Polishers (M)	11-122	Precious Metal Scrap Recovery (M)	3-108
Abrasive Wheels (M)	11-122	Dialysis System (M)	
Abrasive Finishing of Aluminum and Magnesium (M)	11-122	Dialysis for Solution Treatment in the Metal Finishing Industry	4- 52
Polishing Apparatus (P)	12- 56	Electrolytic Removal of Impurities	4- 62
Automatic Polishers (R)	12- 91	Recovery of Waste Water and Chemicals (M)	
Flexible Abrasive Wheels (R)	12- 92	Purification of Cyanide Plating Baths (P)	5-108
Wire Cup Brush (R)	12- 96	Dialysis Separation (M)	7- 77
Belt Polishing Machine (R)	12- 97	Carbonate Removal from Cyanide Baths (P)	7- 97
Abrasive Finishing of Brass and Bronze (M)	12-100	Purification of Nickel Baths (S)	12- 79
Buffs (M)	12-100	RECTIFIERS—See Power Supplies	
Abrasive Belt Head for Curved Surfaces (R)	12- 94	RINSING — DRAGOUT	
Abrasive Belts and Discs (R)	12- 94	Rinse Aid (R)	5- 82
Flexible Shaft Equipment (M)	12-102	Rinse Aid (R)	8- 93
POROSITY		SAFETY, PROCEDURES AND EQUIPMENT	
Gold Testing (S)	1- 65	Dry Chemical Portable Extinguishers (R)	1- 82
Pores and Blistering of Plated Zinc Die Castings (A)	1- 71	Drum Vent (R)	1- 83
Porosity Test for Anodized Aluminum (S)	12- 79	Drum Vent (R)	1- 84
POWER SUPPLIES		Respirator (R)	1- 85
Silicon Rectifier Units (R)	1- 74	Dry Chemical Fire Extinguisher (R)	1- 86
Oven Temperature Control (R)	1- 82	Medium Weight Plastic Gloves (R)	1- 86
Which Rectifier for Electroplating — Silicon or Germanium		Grinding Wheel Safety Booklet (M)	1- 97
Silicon Rectifiers (R)	2- 69	Safety Clothing (M)	1- 97
Hard Chromium Plating (S)	2- 84	Chromic Acid Mist Detector (R)	3- 82
Rectifier Conversion Kit (M)	3- 70	Degreaser Operation (S)	5- 75
Rectifiers in the Electroplating Industry — Rectifiers in the Electroplating Industry	3-109	Fire Extinguishers (M)	5-107
Rectifiers in the Electroplating Industry — Rectifiers in the Electroplating Industry	5- 55	Sweat Absorbers (R)	6-107
Ammeters and Shunts (R)	6- 82	Protective Hand Creams (R)	6-118
Low Range Tong Ammeter (R)	6-110	Eye Shield (R)	6-122
Current Capacity of Cable (S)	6- 74	Carbon Dioxide Extinguishers (R)	7- 85
Generator Brush (R)	6- 89	Health Legislation Concerning Paint Ingredients	8- 68
Standardized Rectifiers (M)	9-120	From Zinc Plating (P)	8- 74
Handling & Power Equipment (M)	9-120	Disposable Work Clothes (R)	9- 99
Power Requirements (S)	10- 81	Acid-Proof Gloves (M)	10- 91
Current Interruptor (R)	10- 88	Industrial Gloves (M)	10-115
Automatic Controlled Rectifiers (R)	10- 89	Coated Work Gloves (R)	11- 98
Recticon Rectifiers (R)	10- 90	Protective Clothing (M)	12-102
Rectifiers (M)	10-114	SOLVENTS	
Generator Brush Maintenance (M)	10-117	Solvent Recovery System (R)	11- 98
Switch for Barrel Plating (P)	11- 86	Safety Solvents (R)	12- 98
Power Supplies (R)	11-100	Polyvinyl Chloride Solvent (M)	12-101
P. R. Rectifier (R)	12- 96	SPOTTING OUT	
PRECIOUS METAL PLATING		Spotting-Out Preventive	6-102
Gold Testing (S)	1- 65	STAINLESS STEEL AND CORROSION RESISTANT METALS	
Immersion Gold (P)	1- 69	Cleaning Stainless Steel (S)	1- 65
Hull Cell Investigation of Rhodium Plating Conditions (A)	2- 80	Anodizing Rack (R)	1- 74
Electron Microscopic Examination of Plated Gold Surfaces (A)	2- 81	Expanded Titanium Sheet for Use in Plating (R)	
Gold Electroplating Process (R)	2- 81	Treating Stainless Steel (S)	1- 76
Slide Chart for Precious Metals Plating Costs (R)	2- 87	Titanium Anode Hook (R)	2- 74
Platinum Coating (P)	4- 78	Titanium Anode Hooks and Baskets (R)	3- 76
Brighteners (P)	4- 80	Anodizing Spline (R)	4- 86
Silver Tarnish (S)	5- 74	Surface Finishing Stainless Steels	4- 89
Carbonate in Silver Bath (S)	5- 76	Plating on Inconel	5- 84
Industrial Applications of Silver Plating (A)	5- 80	Stainless Steel Burnishing Compounds (R)	5- 84
24K Acid Bright Gold (R)	5- 82	Pickling Titanium (P)	5- 76
Gold Plating (M)	5-107	Descaling Refractory Metals (P)	5- 78
Blue Gold Deposits (S)	5- 96	Passivation (S)	5- 89
Bright Silver Finish (S)	5- 96	Pickling and Coating Stainless Steel (P)	5- 93
Bright Gold Process (R)	6- 106	Titanium Fact File (M)	5-122
Plating on Inconel	7- 64	Immersion Plating on Zircaloy-2	11- 68
Buffing Gold Plate (S)	8- 74	Titanium Baths (S)	11- 84
Gold Plated Printed Circuits (P)	8- 76	Passivating Stainless Steel (S)	11- 85
Bright Gold (P)	8- 80	Pickling Titanium and Zirconium (P)	11- 89
Thick Coatings of Bright Rhodium Plate (A)	8- 82	Silver Plating Stainless Steel (P)	12- 82
Electroless Gold Process (R)	8- 95	Descaling Zirconium (P)	12- 83
Rhodium Plating (M)	8- 96	STANDARDS AND SPECIFICATIONS	
Rhodium Bath (P)	9- 92	How to Specify a Painted Finish	3- 60
Holloware Standards (S)	12- 79	Standard Hardware Finishes (S)	3- 70
Silver Plating Stainless Steel (P)	12- 82	Aluminum Finish (S)	6- 94
Decorative Gold Plating (M)	12-100	Nickel Plating Specifications (S)	10- 81
PRIMERS		Plastic Equipment Standards (M)	10-116
Wash Primer (P)	2- 77	Holloware Standards (S)	12- 79
Primers for Vinyl Resin Coating (P)	2- 79	STOP-OFFS	
Etch Primer and Top Coat (P)	3- 72	Printed Circuit Plating and Etching Resist (R)	3- 76
All-Purpose Primer (R)	4- 87	Stop-Off Coating (R)	7- 84
Primer for Rusted, Damp Metals (R)	6-113	STRIPPING	
Rust Preventive Primer (P)	8- 76	Printed Circuit Photo Resist Stripper (R)	1- 74
Paint Primer (R)	12- 97	THEORETICAL	
PUMPS—See Filters and Pumps		Science for Electroplaters	1- 62
		Passivation of Metals as Corrosion Protection (A)	1- 71
		Metal Plating in Sheet Processing (A)	1- 72

Anodic Processes at Metal Electrodes with Electropolishing (A)	1- 73
Formation and Growth of Plated Metal Coatings (A)	1- 73
Science for Electroplaters	3- 67
The Mechanism of Paint Stripping	4- 63
Science for Electroplaters	4- 71
Bright Metal Plating (A)	4- 80
Mathematics for Industry (B)	4-115
Science for Electroplaters	5- 72
Science for Electroplaters	7- 72
Current Distribution Problems	10- 56
Science for Electroplaters	12- 75

THROWING POWER

Effects of Impurities in a Bright Nickel Bath on the Covering Power of a Chromium Bath	1- 58
Current Distribution in Concentrated Electrolyte Solutions (A)	12- 89

TIN PLATING

Methods for Evaluating the Quality of Tin-plate (A)	1- 72
Dull Fused Tin Coating (P)	2- 76
Protective Coating for Tin Plate (P)	2- 76
Stripping Tin Deposits (P)	2- 76
Acid Tin Brightener (P)	3- 74
Liquorics in Tin Baths (S)	3- 74
Acid Tin Bath (P)	10- 82
Hot-Dip Tinning of Cast Iron (A)	12- 84
Modern Developments with Hot-Dip Tinning in Industry (A)	12- 84
Thickness Measurement of Tin and Lead Coatings (A)	12- 88
Aluminum Tinning Process (R)	12- 99

TUMBLING AND BARREL FINISHING

Vibrating Bulk Finisher (M)	1- 97
Media Separator (R)	2- 88
Tumbling Barrels (M)	2-109
Tumbling Barrel (P)	3- 72
Portable Tumble-Finisher (R)	4- 82
Barrel Finishing Media (R)	4- 85
Barrel Finishing Equipment (M)	4-117
Barrel Finishing (M)	4-117
Barrel Finishing Compound Selector Chart (M)	5-109
Barrel Finishing System (R)	6-104
Vibratory Finisher (R)	6-105
Barrel Finishing Compound (R)	6-118
Tumbling Barrel (P)	7- 79
Stainless Steel Burnishing Compounds (R)	7- 84
Vibrating Finisher (R)	7- 88
Barrel Finishing (M)	7- 97
Barrel Finishing (M)	7- 98
Finishing Aluminum Castings (S)	8- 74
Barrel Finishing Compound (R)	8- 84
Barrel Finisher (R)	8- 89
Vibratory Finisher (R)	8- 91
Barrel Finishing Compound (R)	8- 93
Barrel Finishing (M)	8- 94
Media Storage Bins and Pans (M)	8- 98
Barrel Finishing Compound (R)	9-121
Barrel Finishing Media (R)	10- 89
Vibrating Finisher (M)	10- 92
Vibrating Finisher (R)	11-100
Barrel Finishing (M)	11-123
Vibratory Finisher (M)	11-123
Barrel Finisher (R)	12- 91
Barrel Finishing Machine (R)	12- 96
Vibrating Finisher (M)	12-102

ULTRASONICS

Remote Controlled Ultrasonic Generator (R)	1- 78
High Power Ultrasonic Cleaner (R)	1- 79
Ultrasonic Degreaser (R)	1- 88
Ultrasonic Cleaners (M)	1- 97
Ultrasonic Cleaner (R)	2- 92
Testing Ultrasonic Cleaners (S)	3- 71
Ultrasonic Cleaning Apparatus (P)	3- 73
Cleaning of Formed Sheet Parts by Ultrasonics (A)	3- 75
Ultrasonic Degreaser (R)	3- 76
Ultrasonic Cleaning Systems (R)	3- 85
Heated Ultrasonic Cleaning Tank (R)	4- 94
Ultrasonic Degreasing Machine (P)	5- 79
Ultrasonic Cleaning Unit (R)	6-109
Ultrasonic Cleaners (R)	6-114
Ultrasonic (M)	6-124
Ultrasonic Cleaner (P)	7- 80
Ultrasonic Cleaning Equipment (M)	7- 98
Ultrasonic Cleaner (R)	8- 84
Ultrasonic Cleaner Unit (R)	8- 89
Ultrasonics (M)	8- 97
Ultrasonic Cleaner (R)	9- 98
Ultrasonic Cleaning (M)	9-119
Ultrasonic Cleaning Unit (R)	11- 94
Ultrasonic Cleaning (M)	11-123
Ultrasonic Cleaners (R)	12- 90
Ultrasonic Cleaning Unit (R)	12- 95
Ultrasonic Generator (R)	12- 99
Ultrasonic Cleaning (R)	12-100

VACUUM DEPOSITION OF METALS

Plating on Plastics (P)	1- 68
Mechanical Booster Vacuum Pumps (R)	1- 87
High Vacuum Pumps (M)	4-117

Vacuum Metallizing (M)	4-118
Vacuum Metallizing Unit (R)	5- 88
Dip Dyeing of Finishes for Vacuum Metallizing	6- 87
Vacuum Metallizing Quartz (P)	6-103
Vacuum Metallizer (R)	6-111
High Vacuum Pumps (R)	6-117
Vacuum Metallizing (M)	7- 98
High Vacuum Pumps (R)	8- 88
Booster Vacuum Pumps (M)	8- 96
Continuous Vacuum Coating (P)	12- 84

VENTILATION AND EXHAUST SYSTEMS

Fumes from Copper Tank (S)	1- 65
Dust Collector (M)	1- 96
Evaluation of Paint Spray Booths	2- 58
Paint Spray Booth (P)	2- 79
Engineering Equipment (M)	2-107
Dust Collectors (M)	2-108
Exhaust for Hydrofluoric Dip (S)	3- 70
Corrosion-Proof Air Washers (R)	3- 87
Plastic Fans (M)	3-108
Air Filters (M)	3-109
Cyclone Dust Collector (R)	4- 97
Plastic Exhaust Systems (M)	5-108
Industrial Fans (R)	6-115
Dust Collector (R)	6-122
Ventilation and Heat Transfer Equipment (M)	6-124
Dust and Fume Control Systems (M)	6-124
Spray from Zinc Plating (S)	8- 74
Duct Fans (M)	9-122
Cyclone Separators (M)	9-122
Dust Collectors (M)	9-123
Dust Collector Accessories (M)	10-117
Fiberglass Duct Fans (M)	10-117
Corrosion-Resistant Blowers (R)	11- 96
Water-Wash Spray Booth Additive (R)	11-100

WASTES, TREATMENT AND DISPOSAL OF

Regeneration of Spent Pickle Liquors (P)	1- 71
Cyanide Waste Disposal Unit (R)	1- 79
Plating Waste Disposal	2- 61
Clarifiers and Thickeners (M)	3-108
Dialysis System (M)	3-108
Dialysis for Solution Treatment in the Metal Finishing Industry	4- 52
Pickling Waste Treatment (P)	4- 78
Recovery of Waste Water and Chemicals (M)	5-108
Decolorification of Cyanide Waste Waters (A)	6-101
Dialysis Separation (M)	7- 97
Reclaiming Pickling Wastes (P)	8- 91
Waste Pickle Treatment (P)	8- 92
Cyanide Waste Treater (R)	9-102
Treatment of Combined Finishing Wastes	11- 60
Waste Treatment (S)	12- 79
Pickling Waste Recovery (P)	12- 81
Water and Waste Treating (M)	12-101

WATER

Ion-Exchange Regenerator (R)	5- 86
Water Delonizer (R)	6-115
Flow Regulators (R)	6-116
Water Displacing Liquid (R)	8- 90
Rinse Aid (R)	8- 93
Water Demineralizer (R)	8- 94
Water Treating Equipment (M)	8- 98

WETTING AGENTS

Copper Additive (M)	3-108
Wetting Agents (M)	7- 97
Science for the Coatings Technologist	11- 76
Wetting Agent (M)	11-122
Surfactants and Detergents (M)	12-101

ZINC PLATING

Brighteners (P)	1- 71
Chromate Coating for Zinc (P)	1- 74
Chromate Coating for Cadmium and Zinc (R)	1- 80
Non-Destructive Testing of Zinc Coatings (A)	2- 82
Zinc Thickness Tester (P)	3- 74
Acid Zinc Bath (P)	4- 79
Brighteners (P)	4- 80
Bright Cyanide Zinc Bath (P)	7- 79
Spray from Zinc Plating (S)	8- 74
Roll-Top Zinc Anodes (R)	9- 96
Zinc Brighteners (R)	9- 97
Hot Dip Galvanizing (P)	11- 88

INDEX TO AUTHORS

Beach, Warren—When to Consider Automatic Spray Equipment	10- 69
Beck, E. S.—Science for the Coatings Technologist	1-64, 2-65, 3-69, 7-65
Calderon, Ed—Plating on Inconel	7- 64
Cadmium Plating High Strength Alloy Steels	10- 76
Cataldo, J. T.—Which Rectifier for Electroplating—Silicon or Germanium?	2- 69
Cook, Zeke—Traveling Booth for Spraying Railroad Cars	9- 68
Decker, William E.—Improved Pearl Essences	5- 68

Domnikov, Larissa — Bright, Non-Brittle Acid Copper Deposits	8- 66	
Du Rose, A. H.—Copper-Nickel-Chromium and Corrosion Protection	3- 44	
Dufek, Edward F.—Plating Time Determinations	9- 77	
Dvorin, Robert—Dialysis for Solution Treatment in the Metal Finishing Industry	4- 52	
Eibaum, Irving—Do You Appreciate the Dilemma of Depreciation?	12- 66	
Field, George Clayton—Weights and Loads of Parts Made of Various Metal Bars	9- 78	
Findley, Ira—Spray Booths and Ovens on Stilt Solve Space and Quality Problems	3- 64	
Fishlock, D. J.—Composition and Application of Anodes	2-48	
Gary, S. P.—Highlights of the A.E.S. Golden Jubilee Convention	8- 50	
Gaynes, Norman L.—Improved Fluorescent Paints Expand Their Engineering Use—Multicolor Coatings for Corrosion Protection	3- 62	
Hall, Nathaniel—Technical Developments of 1958	9- 73	
Heyson, Allen E.—How to Specify a Painted Finish	3- 69	
Kohan, Leonard R.—Immersion Plating on Zincaloy-Z	11- 68	
Konishi, Saburo—Sulfate Determination in Chromium Plating Solutions	2- 59	
Levy, Charles—Electrodeposition of Chromium Alloys	8- 59	
Marino, Daniel A.—Organic Finishing Developments of 1958	1- 48	
Metal Finishing in Europe Today	12- 64	
Martoff, G. J.—Infrared Baking of Organic Finishes	12- 69	
Mikos, Walter—Plating Waste Disposal	2- 61	
Modjeska, R. Scott—Highlights of the A.E.S. Golden Jubilee Convention	8- 50	
Mohler, J. B.—Specific Gravity of Sulfuric Acid—Aluminum Sulfate Solutions	3- 66	
Plating Tests for Solution Control	4- 55	
Electrolytic Removal of Impurities	4- 62	
Pickling and Acid Dipping of Metals	5- 63	
Analysis of Sulfuric Anodizing Solutions	8- 63	
Control of Watts Nickel Baths	12- 74	
Mohrheim, Dr. Anton F.—Electropolishing of Aluminum, Review and Literature Survey	9- 80	
Pascoe, Walter R.—Fluidized Bed Coating	10- 74	
Perkel, Robert J.—Dip Dyeing of Finishes for Vacuum Metallizing	6- 87	
Petrov, I. N.—Structure and Wear Resistance of Electrodeposited Ferrous Coatings	10- 72	
Pierce, W. J.—Copper-Nickel-Chromium and Corrosion Protection	3- 44	
Pinner, R.—Institute of Metal Finishing Annual Conference	7- 59	
Preuss, Harold P.—Health Legislation Concerning Paint Ingredients	8- 68	
Reed, M.—Anodic Protective Coating on Magnesium	4- 68	
Rousselot, G. E.—Effects of Impurities in a Bright Nickel Bath on the Covering Power of a Chromium Bath	1- 58	
Rousselot, Robert H.—Effects of Impurities in a Bright Nickel Bath on the Covering Power of a Chromium Bath	1- 58	
Current Distribution Problems	10- 56	
Sax, Stanley P.—Better Buffing Through Buff Design	6- 77	
Schore, George—Rectifiers in the Electroplating Industry	5-55, 6- 82	
Seidel, Arthur H.—Inventions and Patents	3- 51	
Serota, L.—Science for Electroplaters	1-62, 2-71, 3-67, 4-71, 5-72, 6-90, 7-72, 8-72, 9-85, 10-77, 11-80, 12- 75	
Spencer, Lester F.—Abrasive Sheets and Bolts	2- 52	
Engineering Uses of Plated Coatings	5- 48	
Surface Finishing Stainless Steels	7- 48	
Fundamental Considerations in Polishing and Buffing	9- 60	
Conversion Coatings	Phosphate Films	11- 64
Spring, Dr. S.—The Mechanism of Paint Stripping	4- 63	
The Not-So-Ideal Cleaning Cycle	10- 64	
Steiger, A. J.—Hard Nickel Plating in Russia	1- 52	
Sukes, George L.—Testing Plating Durability	12- 59	
Szkudlarski, Alfons—Plating Waste Disposal	2- 61	
Tomlinson, J. W.—“Close Plating”—A Page from the Past	10- 62	
Weed, J. Arthur—Dipping and Flow Coating Methods	1- 61	
Evaluation of Paint Spray Booths	2- 58	
Advantages of Spraying with Heated Materials	5- 70	
Hydrostatic Spraying of Organic Finishes	7- 70	
Wernick, Dr. S.—Conference in Retrospect	8- 58	
West, Harry J.—Electroless Nickel Plating of Carbon	2- 64	
Wick, R.—Anodic Protective Coating on Magnesium	4- 68	
Winger, Dr. Alvin G.—Treatment of Combined Finishing Wastes	11- 60	

SUPPLIERS OF EQUIPMENT AND MATERIALS AND ADVERTISERS INDEX

Abbey Process Automation, Inc.	98	Formax Mfg. Co.	108	National Polymer Products, Inc.	
37-01 48th Ave., Long Island City 1, N. Y.		3171 Bellevue, Detroit 7, Mich.		2120 Fairmount Ave., Reading Pa.	
Acme Manufacturing Co.	47	118 E. 28th St., New York 16, N. Y.	117	National Ultrasonic Corp.	
1400 E. 9 Mile Rd., Detroit 20 (Ferndale), Mich.		1558 Brookpark Rd., Cleveland 35, Ohio	97	111 Montgomery Ave., Irvington 11, N. J.	
Acoustics Associates, Inc.	39	4066 Erie St., Willoughby, Ohio	99	New Holland Machine Co.	113
Fairchild Ct., Plainview, L. I., N. Y.		Graver Water Conditioning Co.		New Holland, Pa.	
Agate Lacquer Mfg. Co., Inc.	109	216 W. 14th St., New York 11, N. Y.		N. J. Thermex Co., Inc.	
11-13 43rd Rd., Long Island City 1, N. Y.		1338 N. Elston Ave., Chicago 22, Ill.		535 Bergen St., Harrison, N. J.	
Alchemize Corp.	111	Gumm Chemical Co., Inc. Frederick	Inside Front Cover	Jackson St., Amherst, Ohio	
Congress Expressway & S. Kolmar Ave., Chicago 24, Ill.		538-542 Forest St., Keweenaw, N. J.	116	Northwest Chemical Co.	
Alert Supply Co.		Hamilton Emery & Corundum Co.		9310 Roselawn Ave., Detroit 4, Mich.	41
2041 S. Davis Ave., Los Angeles, Calif.		1601 Douglas Ave., Kalamazoo 54, Mich.		Norton Co.	
Allied Chemical Corp., Solvay Process Div.	15	Hammond Solvents Recovery Service		1 New Bond St., Worcester 6, Mass.	48
61 Broadway, New York 6, N. Y.		241 Brunswick St., Hammond, Ind.		Nudex Products Co.	
Allied Research Products, Inc.	12	Hendy & Harmon	96	Elizabeth, N. J.	
4004 E. Monument St., Baltimore 5, Md.		82 Fulton St., New York 38, N. Y.	52	Oakite Products, Inc.	4
Alvey-Ferguson Co., The		Hanson-Van Winkle-Munning Co.	117	18 Rector St., New York 6, N. Y.	
504 Disney St., Cincinnati 9, Ohio		2022 N. California Ave., Chicago 47, Ill.		Packer Machine Co.	
American Brass Co.		Harrison & Co., Inc.		455 Center St., Meriden, Conn.	
Waterbury 20, Conn.		487 Groveland St., Haverhill, Mass.		Perfecto-Pean Div., Aero-Test Equipment Co., Inc.	
American Buff Co.	117	Harshaw Chemical Co., The	9	p. o. Box 10627 Dallas 7, Texas	
2414 S. LaSalle St., Chicago 16, Ill.		1945 E. 97th St., Cleveland 6, Ohio		Pesco Plating Equipment Corp.	120
American Metal Climax, Inc.	33	Heatbath Corp.		75 Wythe Ave., Brooklyn 11, N. Y.	
61 Broadway, New York 6, N. Y.		Hell Process Equipment Corp.		Pfizer & Co., Inc., Chas.	11
Apothecaries Hall Co., Div. of The Hubbard-Hall Chemical Co.		12901 Elmwood Ave., Cleveland 11, Ohio		630 Flushing Ave., Brooklyn 6, N. Y.	
22 Benedict St., Waterbury 20, Conn.		Holland & Sons, Inc., J.		Philips Dodge Refining Corp.	102
Armitage & Co., John L.	94	478 Keap St., Brooklyn 11, N. Y.		300 Park Ave., New York 22, N. Y.	
245 Thomas St., Newark 5, N. J.		Hoover Chemical Corp.	49	Piling Products, Inc.	104
Atlantic Compound Co.		1312 Union St., Niagara Falls, N. Y.		1509 N. Washington, Kokomo, Ind.	
6 Charles St., Chelsea 50, Mass.		Hull & Co., Inc., R. O.	122	Piling Service & Equipment Corp.	121
Bacon Fat Co.	38	1301 Parsons Ct., Rocky River 16, Ohio		3620 Hart St., Detroit 14, Mich.	
437 W. Water St., Taunton, Mass.		Ideal Chemical Co.		Ramer Equipment Corp.	
Baker Bros., Inc.	122	1499 Dean Dr., So. Euclid 21, Ohio		807 Edgewater Rd., New York 59, N. Y.	
Turnpike St., Route 138, Canton, Mass.		Illinois Water Treatment Co.	101	Randolph Products Co.	
Baker Co., Alan	124	840 Cedar St., Rockford, Ill.		92 N. 12th St., Carlstadt, N. J.	
180 Sylvester Rd., South San Francisco, Calif.		Industrial Filter & Pump Mfg. Co.	32	Rapid Electric Co.	
Baker Co., The M. E.	120	5906 Ogden Ave., Cicero 50, Ill.		2881 Middletown Rd., Bronx 61, N. Y.	
25 Wheeler St., Cambridge 38, Mass.		Industrial Instruments, Inc.		Raybestos-Manhattan, Inc.	
Beam-Knodel Co.	113	89 Commerce Rd., Cedar Grove, N. J.		Manhattan Rubber Div.	
195 Lafayette St., New York 12, N. Y.		Infico, Inc.	14	Passaic, N. J.	
Beke Manufacturing Co.	34	P. O. Box 5033, Tucson, Ariz.		Reliable Industrial Equipment Co.	
947 N. Cicero Ave., Chicago 51, Ill.		Jeico Finishing Equipment Corp.	106	633 Richmond St., Grand Rapids 4, Mich.	
Better Finishes & Coatings, Inc.	91	153 E. 26th St., New York 10, N. Y.		Robertson Fulton Controls Co.,	
268 Doremus Ave., Newark 5, N. J.		Kelite Corp.		Fulton Sylphon Div.	
Bruar Equipment & Supply Co.	122	81 Industrial Rd., Berkeley Hgts., N. J.		Knoxville 1, Tenn.	
602-604 20th St., Brooklyn, N. Y.		Kocour Company	115	Rona Laboratories Inc.	
Buckingham Products Co.		4802 S. St. Louis Ave., Chicago 32, Ill.		E. 21st & E. 22nd Sts., Bayonne 3, N. J.	37
14100 Fullerton Ave., Detroit 27, Mich.		Koppers Co., Inc., Chemicals & Dyestuffs Div.		Sondex, Inc.	
Cadillac Rectifier Div., R.E.P.		Pittsburgh 19, Pa.		61 Van Dam St., New York 13, N. Y.	
Electric Products Co.		Kosmos Electro-Finishing Research, Inc.		Saran Lined Pipe Co.	
571 Webster Ave., New Rochelle, N. Y.		140 Liberty St., Hackensack, N. J.		2415 Burdette Ave., Ferndale 20, Mich.	
Carborundum Co., The		Kushner, Dr. Joseph B.	116	Schaffner Mfg. Co., Inc.	114
Niagara Falls, N. Y.		621 S. Norman, Evansville 14, Ind.		22 Herron Ave., Emsworth, Pittsburgh 2, Pa.	
Chemical Corp., The	78	Lasolco, Inc.	13	Sel-Rex Corp.	Inside Back Cover
58 Waltham Ave., Springfield 9, Mass.		2820-38 Lasalle St., St. Louis 4, Mo.		75 River Rd., Nutley 10, N. J.	
Churchill Co., Inc., Gee. R.		Lea Mfg. Co.	35, 113	Servi-Sure Mfg. Co.	
Hingham, Mass.		16 Cherry Ave., Waterbury 20, Conn.		131 N. Green St., Chicago 7, Ill.	
Clair Manufacturing Co., Inc.	107	Lea Michigan, Inc.	109	Setco Mfg. Co.	108
Olean 19, N. Y.		14459 Wildemere, Detroit 38, Mich.		2286 Babylon Turnpike, Merrick, L. I., N. Y.	
Cleveland Process Co.	95	Lea-Ronal, Inc.	36	Sieben Co., J. J.	107
1965 E. 57th St., Cleveland 3, Ohio		139-20 109th Ave., Jamaica 35, N. Y.		5643 Lauderdale, Detroit 9, Mich.	
Clinton Supply Co.	121	L'Hommedieu & Sons Co., Chas. F.	5	Simonds Abrasive Co.	
112 S. Clinton St., Chicago 6, Ill.		4521 Ogden Ave., Chicago 23, Ill.		Tacony & Fraley Sts., Philadelphia 37, Pa.	
Cohn Mfg. Co., Inc., Sigmund	40	Lindale Equipment & Supply Corp.	120	Sommers Bros. Mfg. Co.	116
121 S. Columbus Ave., Mt. Vernon, N. Y.		504 Smith St., Brooklyn 31, N. Y.		3439 No. Broadwy., St. Louis 7, Mo.	
Colorow Corp.	45	Lowe Brothers Co., The	31	Special Chemicals Corp.	
4515 Superior Ave., Cleveland 3, Ohio		Dayton 2, Ohio		100 S. Water St., Ossining, N. Y.	
Columbus-Southern Chemical Corp.	86, 87	Macarr, Inc.		Stevens, Inc., Frederic B.	8, 105
One Gateway Center, Pittsburgh 22, Pa.		4360 Bullard Ave., Bronx 66, N. Y.		1808 - 18th St., Detroit 16, Mich.	
Conversion Chemical Corp.		MacDermid, Inc.		Stokes Corp., F. J.	
100 E. Main St., Rockville, Conn.		Waterbury 20, Conn.		5500 Tabor Rd., Philadelphia 20, Pa.	
Crown Rheostat & Supply Co.	44	Magnus Chemical Co., Inc.		Storts Welding Co., Inc.	112
1965 Pratt Blvd., Elk Grove Village, Ill.		11 South Ave., Garwood, N. J.		38 Stone St., Meriden, Conn.	
Davies Supply & Mfg. Co.		Mahon Co., The R. C.		Stutz Co., The	103
4160 Meramec St., St. Louis 16, Mo.		Detroit 34, Mich.		4430 W. Carroll Ave., Chicago 24, Ill.	
Davis-K Products Co.		Manhattan Rubber Div.		Surety Rubber Co.	
135 W. 29th St., New York 1, N. Y.		Raybestos-Manhattan, Inc.		Carrollton, Ohio	
Deering, Milliken & Co., Inc.	100	6 Willett St., Passaic, N. J.		Technic, Inc.	
1045 Sixth Ave., New York 18, N. Y.		Manning, Maxwell & Moore, Inc.		88 Spectacle St., Cranston, R. I.	
DeVilbiss Co., The	92, 93	Consolidated Ashcroft Hancock Div.		Titon Products Corp.	
Toledo 1, Ohio		Stratford, Conn.		9301 French Rd., Detroit 13, Mich.	
Diversey Corp., The		McGeon Chemical Co.		True-Brite Chemical Products Co.	
1820 Roscoe, Chicago, Ill.		1040 Midland Bldg., Cleveland 15, Ohio		P. O. Box 31, Olville, Conn.	
Dixon & Rippel, Inc.	115	Meeker Company, The		Turco Products, Inc.	
Box 116, Southington, N. Y.		1633 S. 55th Ave., Chicago 50, Ill.		24600 S. Main St., Wilmington, Calif.	
Djeco Div., Djordjevic Engineering Co.	115	Metal & Thermit Corp.	43	Udville Corp., The	10, 16, 50
1933 N. Damen, Chicago 47, Ill.		Rahway, N. J.		Detroit 11, Mich.	
Dow Chemical Co., The	6, 7	Michigan Buff Co., Inc.		Unit Process Assemblies, Inc.	38
Midland, Mich.		1040 Gaylord Ave., Detroit 12, Mich.		61 East 4th St., New York 3, N. Y.	
Dubois Co., Inc., The		Motor Repair & Mfg. Co., The	122	U. S. Galvanizing & Plating Equipment Corp.	
1120 W. Front St., Cincinnati 3, Ohio		1555 Hamilton Ave., Cleveland 14, Ohio		31 Heyward St., Brooklyn 11, N. Y.	
Du Pont de Nemours & Co., E. I.	19-30	Murray-Way Corp.		U. S. Stoneware	
Wilmington 98, Del.		P. O. Box 180, Maple Rd. E., Birmingham, Mich.		Akron 9, Ohio	
Dytex Chemicals Co.	46	Nankervis Co., Geo. L.	110	Unifltron Instrument Div.	
140 India St., Providence 3, R. I.		15300 Fullerton Ave., Detroit 27, Mich.		United Scientific Co.	
Electro-Glo Co.				204-206 Mills St., Boston, Mass.	
621 S. Kolmar Ave., Chicago 24, Ill.				Universal Corp.	
Engelhard Industries, Inc., Chemical Div.				14841 Meyers Rd., Detroit 27, Mich.	
113 Astor St., Newark 2, N. J.				Virginia-Carolina Chemical Corp.	
Enthone, Inc.				401 E. Main St., Richmond 8, Va.	
442 Elm St., New Haven 11, Conn.				Worthy Products Co.	
Erie Engine & Mfg. Co.				Box 123, Temple, Pa.	
953 E. 12th St., Erie, Pa.				Wyandotte Chemicals Corp.	
Federated Metals Div., American Smelting & Refining Co.				Wyandotte, Mich.	
120 Broadway, New York 5, N. Y.				Zilsite Corp.	
				92 Grove St., Worcester 5, Mass.	

KARATCLAD® outshines solid gold in tarnish test

The solid gold panels, one of 14 Karat the other of 10 Karat, were placed in a humidity chamber containing a pool of 5% ammonium sulfide solution, together with two brass panels electroplated with KARATCLAD GOLD. Exposure for twenty four hours at room temperature produced the results graphically demonstrated in the unretouched photograph. The actual degree of tarnish and discoloration on the solid gold panels may be seen by comparing the middle sections, protected by tape during the test, with the remaining area of the same panels.

The results of this simple experiment are important in the marketing of jewelry, on which low alloy solid gold or clad materials are used. Such products often tarnish, become dull and unattractive while on display in the jeweler's showcase. Not only does KARATCLAD GOLD retain the all important "eye-appeal" so vital to the sale of jewelry products, but its dense, hard surface has excellent resistance to *all kinds* of atmospheric and abrasive conditions. Thus the better wearing qualities and long-lasting beauty of KARATCLAD GOLD PLATE make for profitable repeat sales from satisfied customers.

What's more, the KARATCLAD GOLD PLATING PROCESSES give you the colors your customers want—with no variations from batch

to batch—and a mirror-bright jeweler's finish in any thickness right from the bath. And, you get these sales-increasing advantages at far less cost than is possible with most other gold materials available to the industry.

KARATCLAD GOLD ELECTROPLATE also permits practical and *economical* compliance with the new applicable Federal Trade Commission Rules. The minimum seven-millionths thickness required by the mark "Gold Electroplate", when produced with KARATCLAD, provides all the previously mentioned advantages—without the extra costs and bother of lacquering.

The minimum one-hundred-millionths thickness required by the new quality designation "Heavy Gold Electroplate" is produced in the color you select with a jeweler's finish right from the bath.

We'd be happy to plate samples of your own products with KARATCLAD GOLD—to your specifications—so you can evaluate the merits of this exciting development first-hand. Write, wire or 'phone...we'll make all the necessary arrangements.

In the meantime, for complete literature on the KARATCLAD GOLD PLATING PROCESSES and a copy of the new applicable FTC Rulings, ask for #FTC-G.

*KARATCLAD PROCESS is patented.

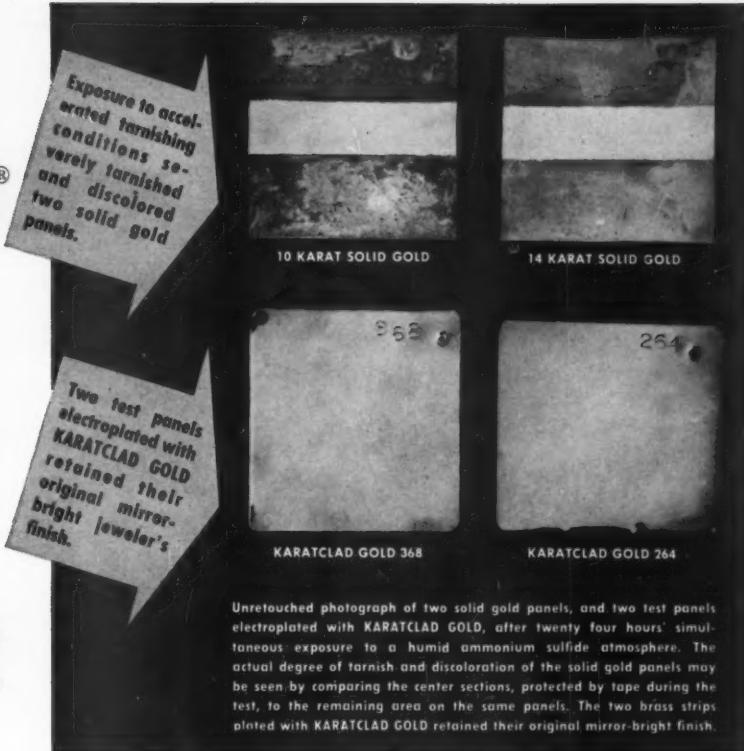
PRECIOUS METALS DIVISION



SEL-REX CORPORATION

NUTLEY 10, NEW JERSEY

Manufacturers of Exclusive Precious Metals Processes, Metallic Power Rectifiers, Airborne Power Equipment, Liquid Clarification Filters, Metal Finishing Equipment and Supplies.



KARATCLAD GOLD 368 KARATCLAD GOLD 264

Unretouched photograph of two solid gold panels, and two test panels electroplated with KARATCLAD GOLD, after twenty four hours' simultaneous exposure to a humid ammonium sulfide atmosphere. The actual degree of tarnish and discoloration of the solid gold panels may be seen by comparing the center sections, protected by tape during the test, to the remaining area on the same panels. The two brass strips plated with KARATCLAD GOLD retained their original mirror-bright finish.



MacDermid
INCORPORATED
...right to the Finish!

WATERBURY, CONNECTICUT
Ferndale, Mich. • Torrance, Calif.

METAL CLEANERS • COPPER PLATING PROCESSES • DRY ACID REPLACEMENT SALTS
MACROMATE CONVERSION COATINGS • ELECTRO AND CHEMICAL POLISHES
BURNISHING AND OTHER METAL FINISHING COMPOUNDS

To all our faithful old friends . . . cherished new friends . . .

all whose friendship we hope to earn in the coming year —

sincere wishes for a Merry Christmas and a Happy New Year!